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UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
SAN ANTONIO DIVISION

AQUIFER GUARDIANS IN URBAN AREAS, and TEXANS UNITING FOR REFORM AND FREEDOM,	)	
Plaintiffs,	)	Civil No. SA-08-CA-0154-FB
v.	)	
US FEDERAL HIGHWAY ADMINISTRATION, AMADEO SAENZ, JR., Executive Director, Texas Department of Transportation, and TERRY BRECHTEL, Executive Director, Alamo Regional Mobility Authority,	)	
Defendants.	)	

ORAL DEPOSITION OF

GEARY M. SCHINDEL

AUGUST 7, 2008

ORAL DEPOSITION of GEARY M. SCHINDEL, produced as a witness at the instance of the Plaintiffs and duly sworn, was taken in the above-styled and numbered cause on the 7th day of August, 2008, from 11:03 a.m. to 2:48 p.m., before Michele W. Kuhlmann, CSR in and for the State of Texas, reported by method of machine shorthand at the Edwards Aquifer Authority, Inc., 1615 N. St. Mary's Street, San Antonio, Texas, pursuant to the Federal Rules of Civil Procedure and the provisions stated on the record or attached hereto.

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A P P E A R A N C E S

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A P P E A R A N C E S (cont.)

FOR THE EDWARDS AQUIFER AUTHORITY:
MR. HUNTER W. BURKHALTER
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ALSO PRESENT:
Mr. Adrian Shelley
Mr. John Bryant

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EXHIBITS

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EXHIBITS
(cont.)

*Retained by Ms. Lisa McClain

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(Exhibits 1 through 6 were marked.)

GEARY M. SCHINDEL,

having been first duly sworn, testified as follows:

EXAMINATION

BY MR. BUNCH:

Q. Good morning, Mr. Schindel.

MR. BURKHALTER: Bill, can I make one quick statement before we start?

MR. BUNCH: Yes.

MR. BURKHALTER: As we read the notice -- Mr. Schindel is here. He's been noticed as Geary Schindel as an individual and he is here on his behalf as an individual. He's not here as a representative of the Edwards Aquifer Authority. Just wanted to get that on the record.

MR. BUNCH: Okay. That's fair enough. And are we in agreement that we're reserving all objections except as to form and responsiveness? Is that --

MS. McCLAIN: That's fine with me.

MS. WINLAND: That's fine.

MR. BUNCH: -- agreeable?

MR. DIEDRICHS: (Attorney nods head.)

MR. BUNCH: Okay.

MR. HAWKINS: The notice says "Chief

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Technical Officer". Is Geary not here in his representative capacity?

MR. BURKHALTER: That is his current job title.

MR. BUNCH: That's his title.

MR. BURKHALTER: But he was not

designated as a representative.
MR. BUNCH: Right. Right.
MR. BURKHALTER: He has not been chosen by the Authority --
MR. BUNCH: Right. Right.
MR BURKHALTER: -- to speak on topic X or topic Y as he's here.
MR. HAWKINS: Right. Okay.
MR BURKHALTER: If he has opinions, they're his own.
MR. HAWKINS: Right. Okay.
BY MR. BUNCH:
Q. Okay. Mr. Schindel, could you just for the record state your full name and where you reside?
A. My name is Geary Michael Schindel. I reside in San Antonio, Texas.
Q. And --
A. Do you want the address?
Q. Yes, please.

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A. 11310 Whisper Dawn, San Antonio, Texas 78230.
Q. Okay. You'll have an opportunity to review the transcript from this deposition to make any corrections that you might find and review and affirm.
A. Okay.
Q. Okay? So that will help us get it to you.
How are you employed, Mr. Schindel?
A. I am employed by the Edwards Aquifer Authority as the chief technical officer.
Q. And what are your responsibilities in that position?
A. In general I am responsible for research programs related to the geology and hydrogeology of the Edwards Aquifer.
Q. Have you had your deposition taken before?
A. Yes.
Q. And so you understand that you're under oath just as if you were in the courtroom?
A. Correct.
Q. And can we get some understanding between ourselves that if I ask a question that's confusing or you're not clear, that you'll ask me to restate it rather than sort of guess at --
A. Correct.
Q. -- what I am trying to mean?

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A. Yes.
Q. Okay. Thank you.
Let's see. When was the most recent time you had your deposition taken?
A. A few months ago, two to three months ago.
Q. And was that in reference to Edwards Aquifer related to business?
A. It was in reference to a lawsuit, I believe, by an environmental group related to the -- a development in northern Medina County.
Q. Okay. And you understand generally that you're

here today to testify in some way that might be used in a pending lawsuit concerning the U.S. 281 project?
A. That's my understanding, yes.
Q. Okay. Can you just tell me a little bit more about your understanding of this case?
A. I really don't have any understanding of what's -- why -- who is suing who and why.
Q. Okay.
A. I mean, I've had no involvement other than I have read the -- I guess the -- this is a toll road --
Q. Yes.
A. -- for 281 that -- you know, there have been some articles in the paper which I've read some months ago and that's really about all I know about it.

Q. Okay. Just to give you some context, I'm Bill Bunch. I represent the plaintiffs in a case that was filed in federal court here in San Antonio representing two nonprofit public interest groups, AGUA and TURF as they're known, and our claims are essentially that the Environmental Assessment that was prepared by TxDOT is flawed legally, it's incomplete and in some instances misleading and that under federal law -- TxDOT was required to prepare a full Environmental Impact Statement under federal law.
So that's the basic setting of this case and I just want you to understand that we have no interest in bringing the Edwards Aquifer Authority into the case and we only sought your testimony because of your expertise.
A. Okay.
Q. Is that fair?
A. That's fair.
Q. Okay. Thank you.
Can you identify what has been marked by the court reporter as Exhibit 1?
A. Let's see here. That is my resume. It was updated. That was provided at the request of our IT -- I understand it's a request that you-all had.
Q. Okay.

A. Yeah.
Q. And is that a current and accurate representation of your professional qualifications --
A. I believe, yes.
Q. -- and experience?
A. Yeah.
Q. Okay. You have a master's degree from Western Kentucky University --
A. Correct.
Q. -- is that correct?
A. Uh-huh.
Q. And my understanding is George Veni also attended that institution. Were you in school with him?
A. He was a year behind me.
Q. Okay. You know Mr. Veni?
A. Dr. Veni. Yes, I do.

Q. Dr. Veni, yes.
Okay. And you've done some research together with him. Is that correct?
A. Correct. And I also serve on the board of directors for the National Cave and Karst Research Institute, which he is the general manager/executive director for. So I'm a board member of that institution, yes.
Q. Okay. But you're not professionally employed

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together with him?
A. No, I am not. We have historically in the past at the Edwards Aquifer contracted with Dr. Veni to do -- basically to provide assistance and consulting services with the Edwards Aquifer Authority.
Q. Okay. And --
A. So I have a professional relationship with him.
Q. Right. And did you-all do that because you generally consider Dr. Veni to be competent in karst hydrogeology?
A. He's a nationally recognized expert in the field, yes.
Q. Okay. Can I have you look at what's been marked as Schindel Deposition Exhibit 2. And if you'll just ignore the document numbers and just read the two sheets that actually have some real information on them.
A. Okay.
MR. BUNCH: And just for the record, this is the Administrative Record Document 413 combined with Document 1511.
A. Okay. It's a long time ago. I don't even remember that meeting, but I assume that there was one.
BY MR. BUNCH
Q. Well, that was my next question.
A. Yeah.

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Q. Did you attend the May, 2001, meeting that's referenced in that document?
A. You know, my business card is here and I can't imagine how they would have gotten my business card if I hadn't provided it so it implies -- I don't recall it, but I assume I was there.
Q. But you don't remember the meeting?
A. No, I -- right offhand I do not.
Q. Okay. Would you have any memory of who may have been at that meeting for TxDOT?
A. The meeting here, this email that's attached to it at the front would indicate that Barrlynn West was there.
Q. And --
A. The other three folks, you know, I don't really recall.
Q. You know Barrlynn West?
A. Yes, I do.
Q. Is that a man or a woman?
A. A man.
Q. Okay. Have you had any subsequent meetings

with TxDOT concerning either U.S. 281 or Loop 1604?
A. I don't recall any. Actually, let me -- you know, I'm thinking back about this, refreshing my memory. Give me a minute.

Q. Sure. Take a few minutes if you need to.
A. You know, I do remember having a discussion but I don't remember exactly who it was -- but it was in the early days when I was here related to the application of certain herbicides and pesticides over the recharge zone, and I'm wondering if this actually may be that meeting. But according to this email it says that it was -- yeah, that's -- well, that's right I'm sure. Yeah.
Q. Well, the agenda does reference item 1D --
A. Yeah.
Q. -- as herbicide and pesticide --
A. Use, that's right. I do remember now discussing that. But to be honest with you, my recollection of that meeting is very fuzzy.
Q. Okay. Is herbicide and pesticide use over the aquifer recharge zone a concern for you?
A. Yes.
Q. Okay. Can you just explain that, please?
A. Herbicides and pesticides can be washed into the aquifer during rain events. The application of them would imply that you have a concentrated solution somewhere and -- probably on the truck that you're spraying the herbicide or pesticide with -- and therefore would pose a spill hazard also.

Q. And so your concern at this time was related to use of herbicides and pesticides by TxDOT along their right-of-ways?
A. Correct.
MR BURKHALTER: Do you mean in 2008 or in 2001?
MR. BUNCH: In 2001.
A. In 2001?
BY MR. BUNCH:
Q. Yes.
A. That's correct. And if I remember right, I have observed herbicide/pesticide spraying on the recharge zone by the Texas Department of Transportation.
Q. Do you know if that practice is continuing today?
A. I have seen applications of pesticides on other roads. I do not know whether the application is still occurring on 1604 or the other roads that cross the recharge zone.
Q. Okay. Are you generally familiar with the section of U.S. 281 from Loop 1604 going north to Borgfeld Road?
A. Yes, I am.
Q. Okay. And is that stretch essentially entirely over the recharge zone for the Edwards Aquifer?

A. No, part of that road is actually over the contributing zone also.
Q. Would that be a northern portion of it?
A. Correct. The Borgfeld Road area, I think, technically is over the contributing zone. The drainage area for the Cibolo Creek is considered the recharge zone. And between Borgfeld Road and 1604 there's an area where there's some faulting and the geologic maps indicate that that is part of the contributing zone.
Q. Okay. Looking again at the meeting agenda, does it -- do you recall -- at the bottom it mentions specifically coordination of information and notification concerning U.S. 281 upgrade?
A. Yeah. I don't remember the specific discussions that were made of that.
Q. Okay. Do you remember any further concerns that you may have expressed about the transport or trapping of hazardous materials along 281?
A. I know that that has been a concern with most of, you know, the transportation corridors that traverse either -- you know, parallel to or perpendicular to the recharge zone so I would suspect that we probably discussed that.
Q. Okay.
A. And I know that this was, I think,

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predevelopment of the city or the county's hazardous materials transport plan, which has since banned the transport of hazardous materials on 1604 except for local delivery I believe.
Q. Okay. But 281 continues to be a hazardous materials corridor. Is that correct?
A. That's my understanding, yes.
Q. Okay. Are you aware of any efforts by TxDOT or by anyone else that maybe seeking to change that designation of 281?
A. I'm not aware of it, no.
Q. Okay. Do you remember if there was anyone else from the Edwards Aquifer Authority besides yourself and Robin Tremallo in the May, 2001, meeting with TxDOT?
A. I don't believe so. I really don't recall.
Q. Okay. Do you remember any kind of follow-up that may have taken place to this meeting?
A. I don't recall any, no.
Q. Okay. If there had been some follow-up to the meeting from TxDOT to the Authority considering technical issues related to the aquifer, would you have known about that?
A. I believe I would have, but again, you know, that was six, seven years ago and to be honest with you, I probably don't recall.

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Q. Okay.
A. There may very well have been some follow-up but I don't recall.
Q. Okay. If I could show you what's been marked as Schindel Deposition Exhibit 3, which is an Edwards

Aquifer Authority letter from Shaun Gibson attached to a open records request that we sent in to your -- to the Authority.
A. Okay.
Q. Do you know Shaun Gibson?
A. Yes, I do.
Q. And who is that?
A. He is our Information Technology coordinator. See -- Information Technology, yeah, he's the program manager.
Q. Okay. And did he or somebody contact you to ask if you would have any information in your files responsive to this information request?
A. Yes.
Q. And you didn't have any?
A. I did not find it.
Q. Okay. And you do recognize this, a letter on Authority letterhead and --
A. Correct.
Q. -- and Mr. Gibson's signature?

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A. Correct.
Q. Okay. If I could show you what's been marked as Schindel Deposition Exhibit 4 and ask you to take a minute to look at that.
MR BURKHALTER: Bill, give us a second to get organized. It looks like I have got three copies of the same thing, and I bet they do too.
MR. BUNCH: Oh, I screwed that up then.
MR. BURKHALTER: That's okay.
MR. BUNCH: Sorry.
This is the May 3rd, 2005, letter.
MR. BURKHALTER: May 3. Okay. Thank you.
This is 4?
THE REPORTER: Yes.
MR. BURKHALTER: Go ahead. Thanks.
A. Okay.
BY MR. BUNCH
Q. Mr. Schindel, do you recognize that letter?
A. I have not seen it before.
Q. Okay. Do you recognize Mr. Potts' signature as general manager for the Authority?
A. I would assume that letter is correct and that it was produced by our staff and submitted to Mr. Potts for signing.

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Q. Okay. And is it standard or regular practice of the Edwards Aquifer Authority to file comments on applications that are filed with the TCEQ for water pollution abatement plans?
A. My understanding is that we receive copies of all the WPAP's or projects within our jurisdiction. We review those and those -- and some of those we comment on.
Q. Okay.
A. I don't think we comment on every one.

Q. All right. And are you generally familiar with the TCEQ's Edwards Aquifer rules?
A. I'm certainly no expert on them. I'm aware that a geologic assessment needs to be performed and some other aspects, but I do not perform them and have not performed them. So I'm familiar that there are requirements, yes.
Q. Okay. And this is -- some of your staff that works for you performs those reviews?
A. Well, they actually work for the Edwards Aquifer Authority. They're not my direct reports.
Q. Okay.
A. Yeah.
Q. But they are your technical folks --
A. Well, they are --

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Q. -- dealing with water quality issues?
A. Well, they are within the aquifer management program, and their job basically is to review WPAP's and to do inspections is my understanding.
Q. Okay.
A. But again, I see those people in the office but I don't work directly with them --
Q. Okay.
A. -- unless there's a particular technical issue.
Q. Okay. And in this letter the EAA is recommending that TxDOT provide hazardous material traps along U.S. 281 at the major stream crossings.
A. Okay.
Q. Were you generally familiar that --
A. Yes.
Q. -- those are the kind of recommendations you might make?
A. Correct. And I understand that DOT has installed hazardous materials traps on those locations.
Q. On which?
A. I believe it's Interstate 1604 on the recharge zone.
Q. Okay. Do you know if they've done that on 281?
A. I do not know.
Q. Okay. So you don't know if these

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recommendations that were made were accepted or rejected --
A. I do not.
Q. -- by TxDOT or TCEQ?
A. I don't have any knowledge of that.
Q. Okay. Do you know if there's been any recent application by TxDOT for water pollution abatement plans --
A. I do not know.
Q. -- that you're reviewing at this time?
A. No. I don't review water pollution abatement plans.
Q. Okay.
A. That would be done by someone else in our staff.

Q. Okay. And you're not routinely given --
A. No.
Q. -- notice that those would --
A. No.
Q. -- be coming through?
A. I'm not involved in that in the day-to-day process.
Again, occasionally I will get involved because they have a technical question related to a karst feature or a karst issue or a groundwater issue.

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Q. Okay. Why -- do you have a general understanding of why you would be recommending or the EAA would be recommending hazardous material traps along 281?
A. Well, that area would be over the recharge zone. The recharge zone itself is considered sensitive to the introduction of contaminants into the aquifer through that area.
Q. Okay. And can you just generally explain why it would be more sensitive than some other location?
A. You want the short answer or the long answer?
Q. How about the medium answer?
A. Okay. We'll skip first the earth cooled.
Q. Right.
A. The Edwards Aquifer is considered a karst aquifer and the recharge zone is considered a karst terrain or topography -- and it's spelled K-A-R-S-T -- and those are usually characterized as a terrain or topography where the presence of sinkholes and sinking streams -- which is characterized by the presence of sinkholes, sinking streams, deranged surface topography, a well-integrated subsurface drainage network and springs. Okay? In essence, you have what's called convergent groundwater flow. You have rapid movement of groundwater in these areas through secondary fractures

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and enlarged features enlarged by dissolution processes so there's virtually no filtration that occurs of water and water can move very rapidly and that the flow paths are difficult to determine.
Q. Okay. And as it relates to hazardous materials -- if I can try to translate, and you can say "yes" or "no" -- there's a concern that if there's a spill it can move into the aquifer and travel very quickly to a water well, for example?
A. That's correct.
Q. Okay.
A. Yeah.
Q. And so it's important to capture that or retard that movement as quickly as possible. Is that correct?
A. There is and there are also strategies for how to deal with a spill on those terrains that would minimize the potential impact of groundwater so the answer is yes.
Q. Okay. So what would the strategies be?
A. Generally, don't spill anything and if you do

spill something only spill good things and if you don't spill good things then retain them.
Q. Would that be beer?
A. Water would probably be the only appropriate substance that would be appropriate for spilling.

Q. Okay.
A. And that you try and contain the spill that -- as quickly as possible, that you not try and dilute out the spill by flushing with water into the aquifer, that you deal with the public safety issue.
You have two issues with a spill. One would be what I call an acute hazard associated with, let's say, fire or explosion or whatever, toxicity. And of course, you want to deal with the acute public hazard or public health issue, keeping people from playing in the spill or whatever people do, working around it without proper safety precautions and equipment. And then the second hazard is a more chronic hazard associated with a migration of this material into a public water supply.
We have measured groundwater velocities in the recharge zone just to the west of 281 at rates of hundreds to thousands of feet per day, up to a mile per day.
Q. And was some of that research measuring that rate of flow research that you did with Dr. Veni?
A. Correct. We basically designed the research. We basically directed Dr. Veni's crew to do much of the technical work, the field work -- going out collecting samples, identifying potential locations to collect

samples -- and then we also trained them in how to use our laboratory instrument and then we basically authorized their -- them to proceed with tracer testing.
And I think we did three different phases involving two or three dyes to each phase in what's called Panther Creek drainage basin, which would be about a mile to the west of 281.
Q. Can you just describe sort of the basic concept of a dye tracing study?
A. Dye is a contaminant and dyes can have lots of different properties. We choose dyes that are shown to not be toxic or carcinogenic or creating any sort of health hazard. As a matter of fact, the dyes we use are generally approved for inclusions in medicine, in food, drugs, cosmetics and that. And we inject those dyes into areas, either into sinkholes or sinking streams or caves or occasionally in the water wells, and then we monitor for those dyes in as many locations as we can.
We have an instrument that can detect those dyes in extremely small concentrations. We collect water samples or we'll collect what are called the dye receptor, which is an activated charcoal packet or some other material that will absorb dye. Then we extract that in our laboratory and we analyze it.
The dyes themselves will give you a flow

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path indication of relationship between a particular injection point and a recovery point. It will give you a time of travel if you collect that data correctly. It will give you a concentration of the dye, which sometimes can be used if the proper -- with the proper techniques to act as a surrogate for a contaminant so that you can proportionately increase the concentrations to determine whether a contaminant may or may not have an impact on a particular receptor.

Dye trace, or what technically is called tracer testing, is probably the most powerful tool that karst hydrologists have in looking at karst aquifers.

Q. And why -- what are the advantages of dye tracing tests in karst aquifers compared to other types of --

A. Well tests or -- yeah.

Q. -- trying to determine flow paths?

A. Hydrologists use lots of different tools, hydrogeologists use lots of different tools, everything from evaluation of individual rock specimens, observations of rock outcrops, the testing of water wells to determine what the physical properties of a well are. Because the karst aquifers are -- have extreme heterogeneity you may see that the physical properties that you measure in the rock at one location

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may not be transferable to a location even just a few feet away.

So these are generally called triple permeability, triple porosity aquifers and so the best way to test regional scale questions is by doing tracer testing because it will test the fabric of the aquifer over a large area versus a water well that, depending on how you run the test, may only test the characteristics of the well bore or may test the characteristics of the area right around the well, which may be only hundreds of feet at most.

Q. Okay. And do they -- are they particularly important also because it's very hard to predict the flow paths in karst terrains?

A. Correct. You can get some generalization by developing what are called potentiometric surface maps from wells, but the most reliable method, the one that's accepted by most karst hydrogeologists -- and I emphasize karst hydrogeologists -- is the use of tracer testing.

Q. Okay. I'll probably come back to that issue a little bit more a little later.

Let me just ask you about what's been marked as Schindel Deposition Exhibit 5, which is an October 7, 2005, letter to TCEQ.

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A. Okay.

Q. Is that similar to the previous letter I asked you about wherein the EAA was providing comments on an application for WPAP filed by TxDOT for Loop 1604?

A. Yeah. It appears to be consistent, yes.
Q. Okay. And I believe you said earlier you thought that TxDOT had in fact installed a hazardous material trap or some --
A. In my travels along 1604 I have observed what I think are some hazardous materials traps located near the interstate, yes.
Q. Okay. You haven't inspected those yourself?
A. No.
Q. You just noticed driving by --
A. Right.
Q. -- that there's some containment facilities?
A. Yeah, a containment facility associated with what appears to be either runoff or spill containment.
Q. Okay.
A. Yeah.
Q. Do you know anything about TxDOT's maintenance practices concerning those facilities?
A. I do not.
Q. Okay. Can I just back up with you? And just briefly state: What is the Edwards Aquifer Authority?

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A. It is the regional -- what is it -- a governmental subdivision of the State of Texas that's responsible for protecting both water quality and quantity of the Edwards Aquifer.
Q. Okay. And does that mission include preserving recharge to the aquifer?
A. My understanding is is that it gives us full powers to do -- to protect the Edwards Aquifer, yes.
Q. Okay. And has the EAA adopted some rules in pursuit of this mission?
A. My understanding is yes.
Q. Okay.
A. Right.
Q. And can you just describe generally what those rules do?
A. The rules that I'm aware of -- and there may be others -- generally ban the installation of new underground storage tanks and places requirements on the upgrading of existing underground storage tanks that contain hazardous materials in the recharge zone. In addition we have programs that deal with abandoned wells and new well construction.
There may be some other programs that are starting up that I'm not familiar with the -- you know, the details on.

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Q. Okay. The Edwards' rules -- or the Edwards Aquifer Authority's rules don't require removing preexisting underground storage tanks. Is that correct?
A. My understanding is that those were grandfathered in and would be allowed to exist but they have to be upgraded to meet tertiary containment within a certain time period.
Q. Okay. And then there's a whole other set of rules that govern managing pumping of the aquifer --

A. Correct.
Q. -- so that the aquifer's not depleted --
A. Correct.
Q. -- of water. Is that correct?
A. That's right.
Q. And is depletion, overpumping of the water, a concern for this region?
A. It has been, and my understanding is that is why the legislature created the Edwards Aquifer Authority.
Q. Okay.
A. One of the primary reasons they did.
Q. And is that challenge to protect the aquifer against overpumping becoming greater?
A. No. Actually, the legislature capped the amount of water that can be withdrawn from the aquifer

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and so there are no new permits being issued for additional water. All of the water has been allocated. And so there are certainly issues related to how best to manage those permits during periods of drought and that.
Q. Uh-huh.
A. But the actual total amount of water that can be removed from the aquifer has been capped.
Q. Okay. As growth continues in the San Antonio region, though, does that create some greater stress on the aquifer?
A. Right now most of the permits are not being fully utilized. Much of that is dependent upon the amount of rainfall that occurs in any given year and so during dry years we see more water being pumped. We have not seen a total use of all of the water that's been allocated yet, but that will occur as growth occurs.
Q. Okay. And is there also a concern on behalf of the Authority about pollution from development over the recharge zone?
A. Yes, there is.
Q. And can you just briefly describe that set of concerns.
A. Well, actually those are concerns that the board has expressed, and to be honest with you, I would

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recommend that you discuss those with the general manager because I'm not always privy to those discussions and the motions. I am, but I'm just -- you know, she would be able to speak on them more knowledgeably than I would.
Q. Well, as a technical person, though, what would be your concerns?
A. About development over the recharge zone?
Q. Right.
A. Okay. Well, we see degradation of water quality in the aquifer through our data. That's directly related to -- many of those contaminant sources are associated with human activities. We see those in the aquifer. So development on the aquifer does impact

water quality and will continue to do so as long as development's on the aquifer.
Q. And what kind -- what pollutant constituents are you seeing that appear to be related to human activities over the aquifer?
A. We see elevated levels of nitrates in the aquifer, many of them related to the urban environment more than the agricultural environment. It is not clear what the exact source of those nitrates are. It could very well be urban landscape application. It could be urban --

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Q. Fertilizers on lawns --
A. Right.
Q. -- and golf courses?
A. Exactly, fertilizers on lawns and golf courses.
The application of -- or, I'm sorry, the use of septic systems in the aquifer. It could be from the leaking sewage -- waste from sewer lines. And then nitrates, fertilizers, are also used extensively in the quarry industry for blasting rocks. You mix it with diesel fuel and ammonium nitrate and you blow things up with it. So it's a very common, very inexpensive explosive used in quarrying operations.
We have seen certain organic solvents that are associated with degreasers or paint thinners or parts cleaners or dry cleaning operations. We've seen small amounts of those in many wells in the Edwards. And we have some wells which -- private domestic wells which have exceeded the recommended drinking water standard for a public water supply.
We have a national priority list, CERCLA, or Superfund site now designated, which has shown -- which was the result of the detection of these contaminants in the aquifer. We have one other national priority list, NPL, site over the Edwards. It has not shown to have impacted the Edwards yet.

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We see trace amounts of herbicides and pesticides in some wells. We do not seem to have problems with heavy metal contamination yet.
Q. And is the likely source of the pesticides and herbicides also lawn and golf course-type maintenance activities?
A. Well, it's difficult to say what the exact source is other than they seem to be more prevalent in the urban area than in the agricultural areas for a couple reasons probably, and one is that most of the agricultural production in the Edwards Aquifer region actually occurs over the Artesian zone because there are sufficient soils there to grow crops.
The detection of herbicides and pesticides in the urban areas may or may not be -- well, are probably most likely related to application of herbicides and pesticides by homeowners. There may be some issues related to golf courses and that, but that's not clear. There hasn't been enough research done.

I will tell you that my experience has shown that most -- or many people who use herbicides and pesticides misapply them. They don't follow the label and they either overapply them or apply them incorrectly in relation to the label. Most of the commercial operators that I know of use herbicides and pesticides

0036

and fertilizers very carefully because they're a major expense and they also usually have applicator licenses and they usually follow those more closely than your average homeowner.

Q. Okay. Are there other pollutant constituents that you're aware of that have been detected in the aquifer that are of concern?

A. We have seen traces of naphthalene, which is associated with diesel fuel. We have seen wells associated with the upper Glen Rose and lower Glen Rose formations, which are contributing to the Edwards, in particular a location at Borgfeld Road and 281, where a spill occurred of gasoline and that material entered -- very rapidly entered into the groundwater system there and contaminated a number of private water supply wells and the direction of the plume was towards Cibolo Creek, which is considered part of the recharge zone for the Edwards. We did not detect that material in the Edwards Aquifer from that incident.

Q. To follow up on that a little bit, if I could show you what's been marked as Schindel Deposition Exhibit No. 6 --

A. Right.

Q. -- and ask you if you recognize that document that has written on the top the number 3?

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A. Do you know the date this was produced?

Q. I can represent to you that I got it from open records requests from the Edwards Aquifer Authority just in the last few days.

A. Okay. I am familiar with -- I'm familiar with most of these incidences. What I was giving you was sort of a synopsis of these.

Q. Yeah. Does one of those entries on this document reference that Borgfeld contamination --

A. I'm not sure.

Q. -- problem?

A. Let me see if it was here.

Northern Bexar County, Borgfeld Road and 281, yes. Edwards Aquifer drainage area, correct.

Q. It's sort of the middle of the second page?

A. Correct.

Q. Pardon me.

A. Yes. This is the diesel fuel spill I was telling you about that occurred at a facility that was mixing explosives in a quarrying operation.

Q. And you're pointing there to the last paragraph --

A. Yes, Southern Comal County --

Q. -- on page 2?

A. Yeah. It says, "Southern Comal County near Krueger Canyon Road and Highway 1863, Edwards Aquifer Recharge Zone".

Leon Valley Road is the PCE contamination, which is now an NPL site. Evans Road/281 is the sewage release. We didn't discuss that, actually. Hollywood Park is another sewage release. Helotes is the fire that occurred and then the PCE spill in Uvalde County, which was one of the first large contamination incidences we had and is still present in the aquifer.

Q. And that occurred how many years ago?

A. 1982.

Q. Uh-huh.

A. And then the West Avenue landfill and Blanco Road area.

Q. So even though at least parts of the aquifer flow very quickly, if you have a contamination event you can still see those over many years?

A. Right. A lot of it depends on the characteristics of the spill, the nature of the material. It is a very complicated process. Some of the areas, especially if they're down in the -- near what I'll call the shallow Artesian portion of the aquifer may very well hold onto and retain contaminants, and we see that with our data where we sample wells and we see continued and persistent detections of certain parameters like PCE.

Q. Okay.

A. So it implies that there is a source somewhere bleeding into the system --

Q. Okay.

A. -- or that the material stored in the matrix is diffusing out.

Q. And you get pulses of it if there's a big rain event or --

A. May very well.

Q. -- the aquifer goes up real high or something like that?

A. Those are all very location specific and contaminant specific, again depending on many factors: The partitioning coefficients of the material; whether it's hydrophobic or not -- you know, how much will mix into the water; whether it's -- happens to have intersected one of these what we call fast flow areas or conduit areas or whether it's caught in the intraconduit areas and the matrix and again being slowly released.

So it's very complicated. The dyes will -- when we tie this back into tracer testing and that, some of our dyes indicate very rapid groundwater velocities with very, very long tails, very sharp arrival peaks. It's an asymmetrical graph where we see break-through curves of these dyes. The dyes probably mimic fairly well what a contaminant might look like and

then you see very, very long tails of concentrations of this material, sometimes for months if not years.
Q. Okay. Could I ask you about this -- let's see. There's a couple of these I wanted to ask you about. The Evans Road/Highway 281, December of 2005 --
A. Correct.
Q. -- event --
A. Okay.
Q. -- was that -- are you generally familiar with that event?
A. I worked on that project.
Q. Okay. And that occurred as a result of some initial construction on 281. Is that correct?
A. That's my understanding.
Q. Okay.
A. A sewer line was damaged, it wasn't probably recognized immediately and the spill contained, if I remember right, for almost a month.
Q. Okay. But 5,000 gallons over a whole month, that seems not to be an enormous amount compared to --
A. Yeah.
Q. One of these other events, I think,

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mentioned -- the next one says 50,000.
A. Right.
Q. Do you know --
A. Well, it's very difficult to estimate the amount of material that's lost. As a matter of fact, my understanding is is that this memo is -- or this document is not correct that reports 50,000 gallons. My understanding is the most recent estimate is 120,000 gallons for the Hollywood Park spill. So 5,000 gallons may be plus or minus a hundred percent --
Q. Okay.
A. -- probably or more. It's very difficult to tell, estimate, the amount of material coming down the pipe, how much was lost, how much bypassed and went on down past the pipe, how much went in the ground, how much was cleaned up.
Q. Do you recall if -- did TxDOT notify you of this spill, the Evans Road spill?
A. I do not recall who initially notified the Edwards first.
Q. Okay.
A. Yeah.
Q. You did go out and inspect the location yourself?
A. Actually, I did not. I did not go out to the

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spill. Our involvement was after the fact, and my involvement was making recommendations for sampling locations and coordinating sampling to determine whether that material had gotten into the aquifer.
Q. Okay. And does this paragraph sort of accurately describe what you were able to find out and not find out?
A. Yes, that's generally correct. We sampled a

number of wells. It says 17 here, and that sounds about right. We did have a well that had a high bacteria count. We do not know why. And we went back to reevaluate that and were not allowed access onto the property. That's correct.

Q. Okay. Concerning the Hollywood Park incident, that's the one you said the current estimate now is 120,000 gallon spill?

A. That's my understanding, was that was when the department -- I'm sorry -- the TCEQ was looking at working through the -- I guess they developed a fine and some other -- there were -- I guess there were regulatory proceedings against the San Antonio Water System, who operated the line.

Q. The sewer line that failed?

A. The sewer line that failed.

And my understanding was, yes, it was

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actually up to about 120,000 gallons of sewage.

Q. Okay. And do you know the cause of the failure?

A. My understanding is a pipe broke, the pipe was related to a force pressure main, the sewer line drains the area north of 1604, basically services the area north of 1604, and that the sewer line came down the creek and reached the edge of -- I think it was Village of Hollywood Park, but I'm not positive. Yeah, it was Hollywood Park. And they did not have permission to run that sewer line down through Hollywood Park so they installed a force pressure main, pumped the sewage uphill to 1604, ran that sewer line parallel to 1604 until it intersected 281 and then ran the sewer line south of 1604 all along 281 until it became a gravity flow system.

That pipe broke under pressure, and my understanding is it spilled sewage for a number of days, if I remember right about three days, before the material -- before the spill was detected.

Q. And was the -- did it just fail out of poor construction, or was there some event of heavy equipment hitting it or something?

A. My understanding is is that it was a failure related to the actual pipe itself, a manufacturing

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defect possibly.

Q. Okay.

A. I did not inspect the pipe and really didn't want to.

Q. Your summary then notes that the area was flushed with potable water?

A. Correct.

Q. Did that create some concerns on your part?

A. Yes. The general recommendation -- now, my background in dealing with spills in karst terrains dates back to my experience as a consultant and also as a -- the manager of the groundwater branch for the State of Kentucky, and the state of Kentucky is -- about

50 percent of the entire landscape for the state is karst, and we were constantly dealing with spill issues in the state and we had developed some recommendations based on our understanding of how karst aquifers behave and how these -- and the concern associated with rapid groundwater velocities or movements that these spills try to be contained and dealt with on the surface.

I think the concern that people have with sewage is that it may very well harbor pathogens which can cause disease. Anything that you can do to keep the public from being exposed to that is important, and so the general rule of thumb that some people use for

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dealing with a lot of these spills is to avoid the contact the public may have directly on the surface. And so you do that by either trying to neutralize the material and/or flush it down the creek where you dilute it out. I think that technique is -- does not take into consideration the vulnerability of the karst aquifers, that literally thousands of gallons a minute were used to flush the dye -- I'm sorry -- to flush the sewage down the creek bed where there was an attempt to try and collect it with septic -- or with vacuum trucks.

My understanding is is that concerning the volume of waste that was spilled and the volume of material that was flushed down the creek bed they did not recover the entire volume and that much of the material probably went into the aquifer -- went into the soil, went into the Edwards limestone that's exposed there at the surface. This is the same technique that we use for flushing our dyes into the aquifer. I have no reason to believe that this material didn't reach the aquifer.

Q. But you didn't see it showing up and actually polluting any --

A. No. We --

Q. -- public water supply wells. Is that correct?

A. That's correct. We did an extensive -- a very

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extensive sampling program involved with every single well that we possibly could find in what we thought was a reasonable area. Our area of concentration was a series of wells operated by Bexar Metropolitan Water District located along Bitters -- at the intersection of Bitters and 281. That -- those wells basically serviced the Stone Oak area. We collected numerous samples from that site and ran them.

The problem was that the -- it was a concern because to test for bacteria one requires that you pull the sample and then you incubate it for 24 hours and then you read the results. And the concern was that the material could be in the well for up to 24 hours or longer, people could be drinking it without knowledge.

The contamination -- or the chlorination processes on the well usually handle low levels of contaminants quite well, but generally when you have a

very large loading like what occurred with a system like this -- a spill like this, then that material could get in the well. Our dye tracing data that we had collected to -- in the drainage basin directly west of this spill site indicated the potential for extremely rapid groundwater velocities in the area. We have measured groundwater velocities over 10,000 feet per day there,

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therefore, there would be sufficient time for that material to get into a well.

Because of the -- we did not -- our sampling program went on for almost a month. We never did see high concentrations of bacteria in any of the wells. I would suspect it's for the same reason that we -- when we did the dye tracing we saw the dye only in a few select wells, not necessarily wells that were associated with large pumping centers like these wells. And again it goes right back to the issue with groundwater flow in karst terrains. These things are convergent, they basically are found in specific conduits or flow paths, and if your well doesn't happen to intersect one of those then you wouldn't recover that material.

So I have -- my professional opinion is no doubt the material went into the aquifer. It just didn't happen to be intersected by one of the wells. And we didn't know that until we tested it.

Q. Right. So basically we got lucky on that one. Is that --

A. I think we --

Q. -- a fair summary?

A. I think we got very, very lucky. That material could have gone into the well in a matter of a day. It

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could have been distributed out through the system and could have resulted in a very widespread case of basically pathogens, you know, in the water supply system for the area around Stone Oak.

Q. So SAWS did not stop using that well for a period of time --

A. Well --

Q. -- during that high risk period?

A. Actually, the well wasn't operated by SAWS. It's operated by Bexar Metropolitan Water District.

Q. Oh.

A. And so the folks who were responsible for the spill was the San Antonio Water System. The well that was most likely to be impacted was -- in my opinion was the Bexar Met well. Bexar Met could not shut that well down because it was -- that well field, of which there are a couple wells there, could not be shut down without basically resulting in a loss of service to those areas so, therefore, your mains would go dry and you wouldn't have fire protection and you wouldn't have any drinking water.

Q. Okay. Let me --

MR. BUNCH: Could you mark that?

(Exhibit 7 was marked.)
BY MR. BUNCH

Q. I don't have extra copies of this, but it's Exhibit 18 from the U.S. 281 Environmental Assessment and it's been marked as Schindel Deposition Exhibit 7 and the legend indicates it shows public water supply wells. Does that show the well fields that you were referencing just now that you were concerned about that Bexar Met operated?
A. No, it does not.
Q. Can you take my pen and mark roughly where those wells are?
A. They're probably down -- using this scale of the map, they're --
Q. So they're south of 16 --
A. They're south, down in -- let's say, in this area (indicating).
Q. Okay. Another what, mile or so?
A. Yeah, they're about two miles --
Q. Two miles south of 1604?
A. Right.
Q. Okay. Are you generally familiar with the public water supply wells that are shown on this map?
A. My understanding is that -- well, actually I would say, no, I am not. As far as I know -- let me see what the direction is here.
You know, the problem with this map is the scale and there are not enough cultural features to be able to really observe those locations. I think that these three wells are located -- or associated with the Cadillac water supply. To be honest with you, I don't know. I'd have to look at a different -- better map.
Q. Okay. Because this map doesn't show the street grid, right?
A. Correct. And in addition -- or topography.
And the other thing is is I don't know if these are public water wells or not. I would be surprised if that's the case. These round circles imply water wells, but I would differentiate between a public water supply well and a private or domestic well and I'm not sure that that does that. Correct.
Q. Well, there's -- I can just show you what's Exhibit 17 from the Environmental Assessment --
A. Okay.
Q. -- that I think includes the private wells.
A. It just says -- it doesn't define. It just says "wells".
I guess why I would say that is that generally we find that south of -- that there are very few, if any, public water supply wells that serve the Edwards -- that utilize the Edwards Aquifer for providing water supply. The furthest north wells that you generally see that are used as public water supplies are generally south of 1604. And so I think while there

are lots of domestic wells and this certainly implies that, I -- you know, I'm not sure that --
Q. So you're not familiar with what are shown on Exhibit 18, Schindel Exhibit 7, the public water supply wells?
A. Yeah, I'm not sure that they are.
Q. Okay.
A. They may be, but to be honest with you ...
Q. You're not familiar with those?
A. I couldn't name the individual wells that you see there.
Q. Okay.
A. I would look at these and say I would suspect that you have a mixture of public and private.
Q. Okay.
A. But I'd have to look at those very carefully. Some of these wells may be serving small subdivisions that are actually in the Trinity.
Q. Okay.
A. Let me see this one here.
I would assume that this map was produced in color; and that may be part of the problem, is that it's hard to discern the nuances in a black and white

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copy.
Q. All right.
A. You know, I find that a little difficult to read.
Q. I think you're right. The original is a color map --
A. Okay.
Q. -- that makes it easier to interpret.
Besides the WPAP's that we've shown --
A. I'm sorry. Can I go back to this map too?
Q. Sure.
A. I think that the other thing I was looking -- the other issue I have with the map, I think, is that it defines Trinity and the Edwards Aquifer as different colors. It maybe should have been labeled "Edwards Aquifer Recharge Zone" and "Edwards Aquifer Contributing Zone". And the reason I say that is that the Trinity Aquifer itself underlies the Edwards and that some of the wells that are drilled in this area may be drilled through the upper units of the Edwards limestone and completed in the lower units of the Trinity Aquifer. And so I would not -- I'm not sure that I think that's a very clear representation.
Q. Okay. Fair enough.
A. And then the other part of that is that, you

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know, our dye tracing data indicates that these two aquifers have -- many people have supposed that both these aquifers are distinct units and that there is no communication between those systems, and our dye tracing has shown that that's clearly not the case in northern Bexar County.
MR. BUNCH: Okay. Can I get this one

marked Exhibit 8?
(Exhibit 8 was marked.)
BY MR. BUNCH
Q. Okay. Schindel Deposition Exhibit 8 is a map also from the TxDOT's U.S. 281 Environmental Assessment, Exhibit 16. It's labeled "Inferred Tracer Flow Paths and MTBE Plume Location". If you could take a minute to look at that and see if that reflects some of you-all's research about a particular spill event.
A. Yeah.
This map is not correct.
Q. Okay. How is it not correct?
A. This appears to actually utilize our tracer testing data. The tracer testing data shows inferred flow paths south from injection points that we utilized to the north, and it also has a triangle area in the legend that says "Tracer detection" and it shows about 20 places where it indicates that the tracing agents

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were detected and those are incorrect.
Those probably should have been monitoring locations. The tracers were detected in just a few wells, which are indicated by the inferred tracer flow path arrows, and I would have to look at our data to make sure that these are actually correct.
Q. Okay.
A. I also do not see a MTBE plume location, and that again may be a factor of a coloration issue or it just wasn't included on the map.
Q. Okay.
A. But I think that what that would be referring to is the Borgfeld Road and 281 spill incident. The MTBE boundary, which is -- I'm surprised they also didn't include the benzene because benzene's a much greater hazard than MTBE is I believe.
Q. Okay. Is it correct to the extent that it suggests that the flow paths were generally north to south?
A. Correct. Our dye tracing data shows that.
Q. Okay. And was that expected or unexpected, or you just really didn't know where it might go?
A. The general consensus is that the dye traces -- I'm sorry -- the groundwater flow in the recharge zone in the Edwards Aquifer would be influenced by large

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faults. Now, the map that you've shown me does not indicate the geology, the underlying geology of the presence of faults. That was the conventional wisdom. It has been reported in documents prepared by the U.S. Geological Survey. However, that assumption was made on the basis that if the stratigraphic -- if the thickness of the Edwards limestone is offset by more than 50 percent that it would become a groundwater barrier.
I'm not -- I have never seen any supporting data for that so we would call that a SWAG, basically a scientific wild ass guess, and our interest at that point was to try and test those theories. We

have very detailed geologic maps in the area so we injected dyes. The conventional wisdom was that the dye would move to the west as it intersected some of these large faults, would probably flow through the northern part of the Bexar County west towards Medina County, move back around underneath San Antonio where it would flow and discharge ultimately at Comal Springs around a water well.

The interesting -- the groundwater model that we -- developed by the U.S. Geological Survey has shown that the actual particle tracking process in that model would indicate that the groundwater flowed to the east at about a mile per year.

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Our tracer testing data, which is empirical data which can be reproduced and has been reproduced -- some of that has been reproduced -- indicates the groundwater flows from the north to the south perpendicular to these large faults. So the faults play very little role in what appears to be deflecting groundwater movement on a regional basis and flows due south at about -- anywhere from 80 feet, if I recall, to about -- to more than 10,000 feet per day.

Q. So is it a fair sort of -- at least one piece of the information you gave us, to summarize that, is that that rapid southward flow was somewhat of a surprise?

A. Not to me, no.

Q. But it was at conflict with the fault lines. Is that correct?

A. It was at conflict with some of the other data that had been generated based on -- well, the other --

Q. Predicting that it would flow to the west?

A. Or to the east.

Q. Or to the east.

A. Correct.

Q. I'm sorry.

A. And with the tracer testing data, you know, and being karsted, our -- we had mapped the potentiometric

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surface in that area and it indicated that the potentiometric surface direction of flow would be to the south.

Q. Okay.

A. And so while I don't think we could predict accurately which well we thought it would occur, we certainly selected all of the wells that we could find in that area to sample.

Q. Okay. Do we have any dye tracing data from the 281 corridor from 1604 up to Borgfeld Road?

A. There's been none that's been produced to date that I am aware of.

Q. Is there any reason why it couldn't be done?

A. It's a question of time and money and expertise. Dye tracing is -- some people call it an arcane or black art. Before we came down here -- there had been a few attempts to try and do dye tracing in the

Edwards before I moved down here. All of them, I understand, were unsuccessful with the exception of one that was done real close to Comal Springs. We were told -- I was told that it would not work, that it's been tried.

But part of the problem is that it is a very difficult place to work for tracer testing. It is one of the more difficult places in the U.S. Very few

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people have the expertise to do it and do it well, and so, again, depending on -- who you would hire to do the work would depend probably a lot on the outcome of -- the success of it. You know, there are folks who specialize in this, in tracer testing. That is what I did before I came down here. And those people would probably not have a great problem with obtaining results.

If you hired someone who has never done dye tracing, again, it would probably be kind of like having, let's say, a capital murder trial and hiring a lawyer who just got out of law school and just passed the bar. You'd probably want somebody with a little experience representing you.

Q. Okay.

A. Yeah.

Q. So help me understand what might be sort of perceived as some confusion in your testimony. I think earlier you said dye tracing was the most powerful tool --

A. Correct.

Q. -- by far.

A. But not the only tool.

Q. But now you're suggesting it's sort of arcane or a black art or maybe it's not --

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A. It's --

Q. -- reliable?

A. Well, no. No, I did not say that.

Q. Okay.

A. Let me clarify.

Q. So help me understand those two points.

A. It is an expertise that's usually acquired through study with someone who has that expertise. Okay? So by many traditional hydrologist's tracer testing is not taught at any of the undergraduate or graduate levels. In addition the subspecialty of karst hydrology, which is a subspecialty of hydrology, generally is not taught. I'm not aware of a single class -- a specific class taught at the university level in, let's say, a spring or fall semester setting, that deals specifically with karst hydrology. To get that expertise, that formal education, one normally needs to go outside of the university or college setting in Texas to obtain or study under a particular person who deals a lot with tracer testing.

Q. For karst --

A. For karst hydrology.

Q. -- aquifers?
A. Well, for tracer testing in general. And most of the tracer testing done in the U.S. that's being done

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in karst aquifers is being done by a small group of people who have developed the expertise to do it.
If you asked an average person who has a background -- an undergraduate or graduate degree in hydrology, chances are they probably are not aware of the techniques and don't understand it. And that's one of the reasons why it hasn't been applied in Texas very well, is because there's very few people in Texas with that expertise to do it well.
Q. Okay.
A. So it is a very standard, very traditional tool. There have literally been thousands of tracer tests done in the U.S. and in Europe dating back into the late 1800s. The dyes that we're using are nothing new. The techniques themselves are not really that difficult if you have experience and understand.
For example, if you didn't design your study well, if you went in here and said, "I'm only going to select one well," chances are you would select incorrectly and select the wrong well and then you would get no results and therefore you would do the dye tracing and say, "Look, it doesn't work." In reality it's a flawed design, and that -- being able to design a good study comes with experience in that.
Q. Okay. And to do one, if you have the right

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expertise to do it --
A. Uh-huh.
Q. -- properly, the results are reliable?
A. Yes, and repeatable.
Q. And is it particularly expensive so you can't do them very often or is it --
A. They're --
Q. -- not so much?
A. They're not cheap, you know, to do one well, you know.
Q. What would be a ballpark figure?
A. You could spend fifty to a hundred thousand dollars to do one, to do a series of tests. The tests in northern Bexar County probably cost us -- I'd have to go back and look at our budgets but around fifty or sixty thousand dollars.
Q. Okay.
A. Maybe a little bit more.
Q. Do we already have a good handle on where the flow paths are in the 281 corridor, or do we not really know?
A. No, we don't. There's nothing unique about the area that we chose to do tracer testing in northern Bexar County, the work there at Panther Creek. The reason we selected that area was just because there was

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a lot of wells available. There doesn't appear to be

anything unique geologically about it so I suspect that the results that we would see would be that groundwater may move very rapid -- would probably move very rapidly through the recharge zone into the Artesian zone from north to south except with the area where you get around the northern area, the study area here marked on the map, where the flow may be actually towards Cibolo Creek. You know, there's probably a groundwater divide in there somewhere.

Q. Okay.

MR. BURKHALTER: Bill, it's 12:20. We've been going for about an hour and twenty.

MR. BUNCH: Yeah.

MR. BURKHALTER: I'm doing fine but --

MR. BUNCH: No. This is a good place. We can take a lunch break and come back. That sounds good to me.

MR. BURKHALTER: Okay.

MR. BUNCH: Is that okay with you?

THE WITNESS: Yeah. Super.

(Break from 12:21 p.m. to 1:31 p.m.)

(Exhibit 9 was marked.)

BY MR. BUNCH

Q. We're back on the record, Mr. Schindel, and I

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want to ask you to start off after lunch here and see if you recognize what's been marked as Schindel Exhibit 9.

A. (Witness reviews document.)

I'm sorry?

Q. Do you recognize that document?

A. I believe I've reviewed that document in the past.

I'm sorry. Let me back up.

Q. Was that prepared by the Edwards Aquifer staff?

A. To be honest with you, it looks to me -- I really don't know.

Q. Okay.

A. To be honest with you, I don't know. There's language in here that probably I wrote that was probably pulled out of old documents. That's why I looked at it and I said -- you know, and I may have reviewed this as a draft, but this -- but I did not prepare this document, no.

Q. Okay. I printed it off the EAA website --

A. Okay. Yeah.

Q. -- this morning.

A. Okay.

Q. But you don't recognize it, or you do?

A. Well, I think I have reviewed this a number of years ago. This is April, 2006.

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Q. Right.

A. And there's obviously some verbiage in here that I probably wrote this and then it was pulled out and put --

Q. Which?

A. -- in the document.

Q. Which?
A. The second paragraph on karst aquifers, I mean, that's almost verbatim from what I just told you earlier.
Q. Okay.
A. And that's some verbiage I commonly use that I wrote many years ago. But I did not prepare the document. I think I reviewed it in its draft form. But to be honest with you, I couldn't --
Q. Was this prepared by the EAA staff for the board?
A. I believe it was. It looks like it was, yes.
Q. Okay. Do you know if the board has taken any action to limit impervious cover over the aquifer recharge zone?
A. They've discussed the issue. To be honest with you, I'm not aware of any action they've taken to date.
Q. Okay.
A. This is more a regulatory document, and you

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know, I deal with the science side, doing research and that so -- I'm aware of some of these things. I do not review them like I used to many years ago and so many times these documents are prepared I haven't, you know, necessarily been in the formal review process.
Q. Okay. Would you agree, though, that it's important to limit impervious cover to -- as an important technique for protecting the aquifer?
A. It is certainly a technique to try and minimize the impact of development. There are people who have used impervious cover as a strategy to try and protect water quality, yes.
Q. Does that also help protect recharge to the aquifer if you limit impervious cover?
A. There's some debate about that issue. Some people will argue with you that having more impervious surface actually improves recharge rather than decreases it because you remove the evapotranspiration, the transpiration part of the equation, so you don't have any trees and grass that are taking the water up and transpiring it so all you have is evaporation.
So some people would claim that actually increasing impervious cover will increase the amount of recharge. The problem with it is is if you allow other activities to occur on the impervious surface you may

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very well decrease water quality. So in a perfect world you would -- and you know, recharge --
Q. Isn't pavement also paving over recharge features?
A. In cases, yes. Yeah, they can be. But there other -- there's -- you know, the recharge zone itself is a recharge feature and what doesn't go in one sinkhole may be available to go into another. Again, if you paved it all off and then channelized all of the water to go off of the recharge zone, then certainly you could decrease the recharge. But in theory, you know,

impervious cover actually collects the water, and then at that point how you manage it may either increase or decrease recharge.
Q. Okay.
A. You could manage it either way. That's a -- this is all theoretical.
Q. Okay. Are you -- do you know who on your staff prepared this document?
A. I would suspect that it was done by Mr. John Hoyt.
Q. Okay. He deals with more of the --
A. Regulatory side, yeah.
Q. Regulatory meaning --
A. Development of the regulations.

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Q. -- regulation of potential polluting activities?
A. Right.
Q. Okay.
A. Right.
Q. All right. Would you have any -- do you have any professional disagreements with -- to the extent you're aware of this document?
A. I'd have to spend a few minutes to read it, but I would suspect that most of it's based on the research, you know, that's been done by our staff.
Q. Okay. Are you generally aware that the Edwards Aquifer rules do not limit impervious cover?
A. That's my understanding currently. The -- well, I'm sorry. Back up. The Edwards Aquifer Authority rules do not.
Q. Right.
A. Now, my understanding is is that there are rules through TCEQ on -- you know, the 213 rules, that if you have a certain level of development with a certain level of impervious cover that you need to measure to mitigate that.
Q. That triggers higher protection measure requirements?
A. Correct.

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Q. But it doesn't say you actually cannot build additional impervious coverage?
A. That's my understanding, but again, I'm not an expert on the TCEQ 213 rules.
Q. Okay.
A. Yeah.
Q. Do you know if any of the other governmental entities that have jurisdiction over the Edwards Aquifer watershed have rules limiting impervious cover?
A. I'm not aware of any.
Q. Okay.
A. But there are a number of different regulatory agencies out there, you know, that deal with either all or parts of the Edwards.
Q. Okay. Are you aware of the state grandfathering statute that provides some limits on

local jurisdictions in their efforts to manage development?
A. I've heard of it, but I'm not again --
Q. You're not informed of how that works?
A. I wouldn't call myself really informed about the process, no.
Q. Okay.
A. There are certainly other folks who know a lot more about that in this agency.

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Q. I noticed on your resume you list a co-authorship with Dr. Veni of a GIS paper or exercise related to trying to identify priority protection areas for endangered karst dwelling invertebrates?
A. Actually I think that paper dealt on a peripheral basis with that. I believe it was actually more related to using the GIS process to try and prioritize procurement of properties for protecting recharge of which one of the components was endangered species, but there were some other components there too.
Q. Okay.
A. I've written a lot of papers and I don't recall every single one of them.
Q. Let me see if I can just put my finger on it.
A. It would probably be one of the more recent ones.
Q. (Attorney indicates.)
A. Yeah, this is for karst area protection purchase and protection, and this was really a spinoff -- an outgrowth of the Prop 1/Prop 3 process where myself, George, Kurt Nixon and some others here worked on a process to try and develop a GIS program that would allow us to prioritize purchase of properties by the Prop 1 and the Prop 3 program.
Q. And do you recall if that exercise identified

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any priority protection areas in the 281 corridor?
A. How wide would the corridor be?
Q. Well, say five miles either side.
A. I believe that, yes, there certainly were areas that were listed as higher or lower priority --
Q. Okay.
A. -- within that area. Yes, certainly.
Q. Okay.
A. I'm almost certain there would be.
Q. Does the EAA typically work with other government agencies when they need some information about what their activities might mean for the Edwards Aquifer?
A. We do. We do.
Q. Okay. And if TxDOT had asked your agency to comment on the draft Environmental Assessment, would you have done that?
A. That would be a decision by the general manager, but I think we are commonly asked to -- you know, to review and/or give input on development of various local and regional planning activities.

Q. So that would be something typical that you would do?
A. Yeah. I wouldn't say it would be untypical at all.

Q. And if they had further engaged you to help them with studies of potential impacts, would you -- your staff have been willing to do that?
A. Yes. Now, again, what you're talking about, policy issues, are related to the general manager and it would be her or his prerogative whether we would do that or not.
We certainly have -- for example, we have an interlocal agreement with a number of different agencies that cooperate on various activities. We have one right now that we've just passed with Kinney County. And we're going to be dye tracing in Kinney County, which is outside of our jurisdictional area, but we're interested in some groundwater issues that may impact the Edwards over there and so we're working with them on a cooperative basis.
Q. And is that just pure research, or are you also helping identify mitigation or protection measures that might be --
A. No, it's just basic research. It's looking at groundwater flow paths and groundwater velocities. And then that data would be used to help us refine our groundwater model, our groundwater -- our area of recharge, and contributing of -- and refining the contributing area. I'm sorry. And then it would help us close or better refine our water balance, or water coming in and water going out of the Edwards, and then that data would probably be useful for the groundwater conservation district there.
Q. Okay. But in other contexts, you know, such as the comments on the WPAP applications, you would offer some expertise in recommending mitigation strategies, for example?
A. I think we have done that in the past on a number of different levels. I know that we are very interested in doing tracer testing. We have worked with other agencies and other groundwater districts, our sister agencies on either side of us, to perform these kinds of studies. We've done them for universities as demonstration projects. In relation to cooperation with other agencies, I know that we have acted as an advisor to Texas -- TCEQ for environmental incidences like the releases of sewage, the Helotes fire and others.
Q. Okay.
A. So we work very cooperatively with most of those agencies.
Q. And you-all have recently developed a spill response plan --
A. Correct.
Q. -- is that correct?

A. Uh-huh.
Q. And what instigated that exercise?
A. That was developed in another program so I have been given a copy of it but have not reviewed that in detail, was not asked to review or comment on it in detail and have not done so. But the -- I assume that it probably is a result of the -- some of the spills that we've had, you know, in the area, environmental incidences.
Q. And perhaps a perception that there wasn't a good spill response plan in place from some other agency?
A. Well, you know, I haven't reviewed the other agencies' spill response plans so, you know, I would not know whether those are not -- whether those are in place and if so have they been followed.
Part of the problem is is that each spill or incident has its own unique characteristics. You know, I think our intent was that the unique nature of the Edwards being extremely vulnerable to contamination would be taken into consideration and that the techniques that you would apply to a spill, let's say, over another aquifer type that may not be nearly as vulnerable may not be applicable to the Edwards, you know, could result in actually a much worse problem than

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what you were trying to solve.
Q. And that's mainly this idea we mentioned briefly earlier you're washing the pollutants into the aquifer --
A. Yeah.
Q. -- in the process of trying to put out a fire, for example?
A. Yeah. Or, you know, with a sewage issue it would be a contact -- you know, trying to get the sewage away from where it may come into contact with people and --
Q. Pushing it into the aquifer?
A. Yeah.
And so what you're doing is trading one potential hazard for maybe a much greater hazard. You know, it's a lot easier to control, you know, an incident on the surface by excluding people from it and then cleaning it up than it might be to flush it into an aquifer and not knowing where it's going to come out or when it's going to come out or who it's going to impact.
Q. Right.
A. So that's, you know, probably not a very good trade.
Q. So we've discussed these two incidents where sewer lines along 281 or 1604 have broken.

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A. Uh-huh.
Q. Is there a good map that shows where all these sewer lines are in these highway corridors?
A. I would suspect that the facilities that maintain those would be the ones who would have the best

maps.
Q. Okay.
A. I think that we have received some maps internally, but we're not the ones who update, keep those up to standards and that so ...
Q. Okay. Wouldn't that be a sort of first step in trying to make sure these accidents don't happen again, identifying where these facilities are located?
A. That may be one area where you would want to approach, yes.
Q. Okay. Dr. Veni had provided an affidavit for us in a previous iteration of this litigation and had expressed opinion about the difficulty of assessing the significance of a recharge feature to recharge purely by a surface inspection.
A. That's correct, and I'm in agreement.
Q. Are you generally familiar with that concern?
A. Yes, and I've expressed that myself.
Q. Okay.
A. Yes, it's a concern.

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Q. Can you just sort of explain that a little bit?
A. There is, again, a lack of -- sometimes a lack of clear understanding about how these karst terrains function and the understanding of what a karst terrain is. It is not uncommon for people to look at a sinkhole and say, "See, there's a karst." In reality a karst is a terrain or a topography and a sinkhole wouldn't be a karst. A sinkhole would be within a karst landscape or terrain.
And really it comes down to a lack of education, a lack of training, a lack of experience in identifying them. Many people don't recognize them. They may -- they don't understand how they necessarily interconnect with the groundwater system. Or the philosophy is that I have observed and delineated all of the sinkholes and so, therefore, we have mitigated concern we have about a sinkhole being a recharge feature so we have taken certain mitigation standards. In reality the sinkholes indicate that they -- that the terrain is vulnerable but it's not the only source of potential contamination, the only mechanism for transmittal of a contaminant from the surface into the groundwater.
We have done dye tracing where we have gone into areas in between sinkholes, have injected

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dye -- or basically placed dye on the ground, flushed it in with a garden hose over some period of time -- and we have seen that that material has moved very quickly through the subsurface and into water wells.
So the mind-set sometimes is that we can delineate a sinkhole and as long as we protect the sinkhole the water supply is safe and you can do whatever you want in between these what are called intra-sinkhole areas, and in reality that's not true.

Q. Okay. So let me see if I can try to put this concept in layperson standards a little bit.
If you're out on the recharge zone, that's the karst terrain.
A. Correct.
Q. So the whole landscape basically.
A. Correct.
Q. And maybe you don't even see any big sinkholes that are obvious conduits.
A. Even small sinkholes.
Q. Or even -- yeah. Maybe it looks like it's not a recharge location.
A. Right.
Q. But if you brought a fire hose out there and shot it out there, it would still disappear. Is that --

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A. Yeah.
Q. Is that a --
A. Yeah. The water --
Q. -- fair characterization?
A. Yes. The water wouldn't run off of -- or if you were to, let's say, mimic a sewer line -- and we know that sewer lines leak because they allow water in when it rains, they allow sewage out when it's not raining -- a sewer line leaks. So you could have a small leak and -- or a relatively moderate leak, and unless that leak actually bubbles to the surface like occasionally occurs with a force pressure main, that material is going in the aquifer. So the --
You could do the same thing with a tanker truck by just opening the valve up and letting it run out at 10 or 15 gallons a minute. And it wouldn't run off. It would run a little distance and probably sink into the ground.
Q. So if you have a geotechnical assessment like is required for the Edwards rules and the inspector did a perfectly professional job and said, "Oh, you know, here's a feature but it looks small," and so they declare it insignificant --
A. Right.
Q. -- that doesn't really give you a level of

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certainty that nevertheless it might provide for significant recharge. Is that correct?
MR. BURKHALTER: Bill, clarify what you mean about -- you said as required by the Edwards rules.
BY MR. BUNCH:
Q. The TCEQ Edwards rules.
A. Right.
You can't necessarily judge a -- the significance of a karst feature by its surface expression. For example, one of three caves in the entire county that is called Genesis Cave, it was located on the edge of what most people would consider a very obscure and insignificant depression. And it was dug out by some cavers and the cave is 250 some feet deep and is one of three caves you can see -- actually

get into and observe the water table in the Edwards limestone. If you'd looked at that, you would probably consider that a very insignificant karst feature.

Those are probably very common. And so any -- you know, we -- the development of the vulnerability map related to -- or, excuse me, of the map that was used to support the GIS process for Prop 1 and Prop 3, the scientist who developed it realized there's a lot of limitations to that map because we assume that we know all of the sinkholes and we know all

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of the caves and we know all of the fractures and we know all of the faults and we don't. And so it's the best estimate that you can get as far as vulnerability is concerned.

Some people are splitters. They like to assign a value to a particular feature and then overlay those on different layers to create an overall vulnerability. I'm more of a lumper and, you know, my philosophy on that is any part of it that is in the recharge zone, any part of it that is part of the carbonate -- the limestone system in the Edwards is vulnerable, and trying to split hairs to talk about, you know, degrees of vulnerability is really kind of a futile attempt. It's all vulnerable.

Is there any one place you would prefer to spill 100,000 gallons of gasoline versus another place? And the answer is if it's on the recharge zone, no, don't spill it anywhere, you know.

Q. Okay. The EA for the 281 expansion toll road project states that there will be a hundred -- 1.5 million cubic yards of cut.

A. Okay.

Q. And so that indicates some amount of gouging into the aquifer.

A. Okay.

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Q. Would you expect that they would encounter --

A. I don't think --

Q. -- voids in that process?

A. Well, let me say I don't think they're going to cut into the aquifer in the sense that they would have to cut a very deep hole, 200 and some feet deep, to actually intersect groundwater. However, they would be -- from your discussion it sounds to me like they would be removing part of the limestone filler --

Q. Yeah, not -- this wouldn't be --

A. No.

Q. -- vertical, but you know --

A. They wouldn't be cutting into the aquifer. They're cutting into the --

Q. Into the --

A. -- Edwards formation.

Q. -- into the formation, correct.

A. Right. That's what I wanted to clarify.

Q. Right, above the water table.

A. Yeah, it wouldn't surprise me at all if, you

know, there were a number of karst features that were intersected.
Q. Okay.
A. I'd be surprised if there weren't karst features intersected.

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Q. And are there techniques to try to -- I mean are there like radar or sounding kind of techniques that you can try to look below the surface and get some handle on what kind of voids might be there?
A. Yeah, there are techniques, there are methods. They all have their advantages and disadvantages. You know, it starts with -- you know, I guess it starts with having someone who understands the conceptual flow processes in these karst environments. Basically they, you know, need to know their ass from a hole in the ground, not to be funny. Not everyone does.
Q. Right.
A. Though there are certainly very many accomplished and very professional people working on these processes and that. So having some experience in looking at these things and digging these things open and looking at what looks like a significant feature and what isn't requires a fair amount of experience. Okay?
Then there are -- that's the direct observation issues related to having someone assess the problem. What you really want is not someone who may be a geotech engineer because in many cases those folks don't know their ass from a hole in the ground when it comes to karst. What you really need is someone who has training or background as a karst geologist or karst

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hydrogeologist because in many cases these features are very subtle.
That doesn't mean that there aren't very good geotech engineers out there. Certainly there are many who are very familiar with sinkholes and sinking streams and some of the karst problems. But I've also worked with a number of them across the country and not every one of them is very well versed in it.
I don't know who worked on this. I haven't, you know, reviewed their work or anything.
Q. Uh-huh.
A. There are some geophysical techniques that one can use to try and identify karst features and they have varying degrees of sensitivity or resolution. And again, geophysics -- those geophysical techniques much like dye tracing require someone who's very experienced in performing those and evaluating those studies. Otherwise you're going to miss a lot of data and misinterpret it. So a lot of it comes back to the level of expertise of the individuals doing the work.
There are techniques where you can go do borings, and in many cases that's the first tool that most geotech engineers use to look at foundation stability issues. But most really good geotech engineers who have worked in karst a lot also realize

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that there's a serious eliciting problem with their sampling related to borings, and that is that the -- there are always limits on the amount of samples that one can take based on time and based on money and the fact that are the number of borings you have sufficient to represent the variations in the physical features of the property that you're dealing with. Did you take enough soil samples of borings in that? And again, I can't really, you know, offer an opinion on this project because I haven't seen it.
Q. Right. You haven't reviewed any of the studies that have been done --
A. No, sir.
Q. -- on 281?
A. No, sir.
Q. Okay.
A. I don't know who did the studies. I don't know whether they were done internally or externally or if they had a consulting firm doing them, if they've done any geophysics. I would hope that if they did any dye tracing they would have contacted us because there's a potential for interfering -- you know, if you are dye tracing an area, generally you want to contact other folks that might be doing this to minimize the potential for interference with dye tracing.

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We kind of act as that clearinghouse so I'm not aware of anybody else doing any tracing related to 281.
Q. Okay. Well, if they did any, we don't know about it?
A. Right. Yeah.
Q. Are there pollution concerns that are particular to the construction phase of a large project?
A. Yeah.
Q. And to put this in context, we're talking about probably four to five hundred acres of construction site over this 7.9 mile length of highway.
A. You probably need to clarify that area because that sounds like a very small area for the length of the highway you're dealing with.
Q. Well, if you just take, you know, a 400 foot right-of-way --
A. Okay.
Q. -- by 7 1/2 miles.
A. Okay. That comes out to four to five hundred?
Q. I came up with -- I don't know -- 500 acres, I think.
A. Okay. I'll trust that --
Q. Something like that.
A. -- number is accurate. I don't know.

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You know, there are a number of issues related to construction on karst. There are subsidence issues, which this area doesn't seem to have much of. There's sinkhole flooding issues related to, you know,

trying to design drainage-ways off of these and we do have a few places around here that do have sinkhole flooding issues. You are also dealing with the transport of sediment off of these sites. My understanding is TCEQ had some pretty stringent sediment control requirements during construction.

Of course, one of the most common problems associated with construction is damage to fuel tanks on vehicles where, you know, maybe as much as fifty to a hundred gallons of fuel could leak out of a tank that gets punctured by a rock or by a piece of construction equipment. It leaks out onto the construction area. And those are actually not uncommon to occur.

That volume of material probably -- as long as it's mitigated, cleaned up, you know, usually it will spill on the soils or something and those are scraped up and dealt with -- probably are not a huge concern, not like 120,000 gallons of sewage.

Q. So with the sedimentation controls that you mentioned, do you have any sense of their effectiveness?

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A. You know, they seem to work during moderate rain events and small rain events, and of course during large rain events they get washed away. Again it depends on the diligence of the folks who are maintaining them and whether there is sufficient oversight to make sure they're maintained correctly.

Q. Do you have any sense of the degree of compliance with TCEQ's Edwards rules?

A. I do not.

Q. Okay. You-all haven't tried to --

A. I have not.

Q. -- assess that?

A. I have not. I -- no, we have not.

Q. Okay.

A. Now, I don't know if anyone else in the program has, but I certainly have not.

Q. Okay. You're generally familiar with the rapid amount of urbanization taking place in the 281 corridor?

A. Yes.

Q. Okay. Are you aware of whether there's been any effort by any agency or group to estimate or assess the cumulative effects of pollution from that urbanization?

A. What kind of effects would you be -- you know, are you -- I mean ...

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Q. Well, like predicted pollutant loadings --

A. Pollutant loadings?

Q. -- if there was full build-out of development that's being mapped out.

A. I don't believe that that has been assessed. There's -- we have been running water quality samples, you know, from the aquifer itself over a large area for a number of years now and so we do have a monitoring network where we've looked at a wide range of parameters

from individual wells. In those -- some of those wells we do see the effect of human activities.

As far as I know, I am not aware of any regional scale studies trying to look at the total loading off of an urban area in relation to the potential impact for groundwater. Now, those kinds of studies, I think, have been done in support of surface water runoff programs and that's through what's called a TMDL program.

Q. Uh-huh. And --

A. But we have not done any on the Edwards.

Q. So there are common techniques that can take development parameters like impervious cover, percent of impervious cover, that then estimate pollutant loadings from that, and you can sort of multiply that by acres and get some estimated increases in loadings for a

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number of pollutants?

A. My understanding is that you can get estimates on that if you use certain programs. For example, there are a couple of surface water runoff programs that also have a water quality characteristic to them. And we have actually developed some of those models for surface water runoff related to the recharge zone or the contributing zone of the Edwards, but we have not initiated the chemical transport or concentration aspects of those programs yet. They're still in the development phases that we received them and we're trying to work with them and test them and make sure that they're calibrated, improved.

Q. If there were a cumulative effects analysis done on the sort of projected development in that corridor, would that be useful to the community?

A. Yes, I think it would be very interesting.

We have discussed here trying to develop a research initiative related to what's called assimilative capacity of the aquifer, what's the ability of the aquifer to basically assimilate contaminants in it. And it's very, very difficult to try and determine that in a karst environment because it's difficult to define what your groundwater sheds are. And our tracer testing is really the first step in what is probably a

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very long road to try and determine what the capacity of the aquifer is to be able to attenuate contaminants.

My impression is is that the data we have already indicates that we have exceeded that capacity because we're now seeing a response in the wells and so certain parameters are no longer able to be attenuated by a dilution by biologic action, by matrix effusion, by all of the other processes that take place in the aquifer. And so what you see is an increase in the concentration of those parameters in groundwater monitored by some wells.

Q. And this research, initial research you've done, are you able to tell if that's sort of aquiferwide trends or is it more localized pollution happening in

little pieces, conduits, what have you in the aquifer?
A. Well, it seems to be associated with urban areas. Our highest water quality areas are more rural areas, especially those areas that are more ranch land versus agricultural. So our concentration increases related to either point -- what I'll call point or non-point sources appear to be in the urban areas, yeah.
Q. Okay. And is there any reason to think that won't get worse with more urbanization?
A. No.
Q. And if you're trying to assess the potential

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pollution effects from a given -- in a given area, is it important to look at that particular area as opposed to putting it in the context of the entire aquifer?
A. I think the answer would be yes.
MR. BUNCH: Okay. If we could just take two minutes I think I'm basically done, but I want to look at one thing here.
(Break from 2:11 p.m. to 2:16 p.m.)
(Exhibits 10 through 13 were marked.)
BY MR. BUNCH
Q. Mr. Schindel, are you generally aware of the 183A highway project over the recharge zone up in Williamson County?
A. No.
Q. No? Okay.
There, because of concerns about endangered cave-dwelling invertebrates, Fish & Wildlife had TxDOT -- required that they have a karst hydrogeologist on site during construction in case they encountered karst features. Do you have any opinion about whether that would be a good technique if this project went forward, to have somebody like that out there?
MS. McCLAIN: I'm going to object to that to relevance. We've already had some questions about

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fixing up roads we questioned the relevance of, but 183 I don't believe is in the Edwards Aquifer Authority's jurisdiction so I don't think this witness should respond to that.
THE WITNESS: As far as I know, it's not.
BY MR. BUNCH
Q. You can answer the question, or if you'd like me to restate it.
A. Yeah, please. Please do.
Q. Okay. In your opinion would it be a good idea if this project goes forward for TxDOT to have a karst specialist out there during construction to watch for --
MR. BURKHALTER: Do you mean a --
BY MR. BUNCH
Q. -- what they encounter?
MR. BURKHALTER: Are you talking about a biologist or -- you said a karst -- I think earlier you said a biologist or --
MR. BUNCH: No, a hydrogeologist.

MR. BURKHALTER: Hydrogeologist. Okay.
A. Yeah, someone with expertise and a specialty in karst hydrology would probably help to identify karst features if they were intersected during the construction.
BY MR. BUNCH

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Q. Okay.
A. And also to consult on mitigation of those if it's intersected.
Q. Right.
Okay. Are you generally familiar with whether TCEQ -- their level of resources for enforcing the Edwards rules?
A. No, I'm not.
Q. Okay. So you don't have any opinion as to whether they're aggressive or --
A. No.
Q. -- to nonexistent?
A. Yeah, I have not worked in that area so I do not know.
Q. Okay. Are you familiar with a geologist named Charles, or commonly known as Chock, Woodruff?
A. Yes, sir.
Q. Okay. You know --
A. I've met him.
Q. -- Dr. Woodruff?
A. Yes.
Q. Okay. I'll just represent to you that he did do a study for TxDOT on this 281 project, although for some reason it was not actually cited or referenced in the EA.

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MS. McCLAIN: I'm going to object to that being testimony about our EA.
MR. BUNCH: Okay. Your objection is on the record.
MS. McCLAIN: Understood. Thank you.
BY MR. BUNCH
Q. I want you to read one section here and just tell me if that would be something you might agree or disagree with. I'll just mark it.
If you could just read that last paragraph on page 52. This is --
MS. McCLAIN: What document is that?
MR. BUNCH: For the record, this is Document 1396 in the administrative record.
A. (Witness complies.)
BY MR. BUNCH
Q. Yeah. If you need to read the preceding paragraphs to get context, I don't want to -- it's not a trick question.
A. Okay. I'm sorry. What's your question?
Q. So I guess my question is: Is that an opinion that you would share or you would have some disagreement with?
A. No, I would share that opinion.

MS. McCLAIN: Can we know what the
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opinion was?
MR. GILBERT: Yes.
MR. BUNCH: It's the last paragraph on
page 52.
THE WITNESS: Right.
MS. McCLAIN: We don't have that in front
of us. I'm sorry. Could you summarize for us for the
time being?
MR. BUNCH: It's addressing potential
cumulative impacts.
MS. McCLAIN: Okay. And what's the
opinion?
MR. BUNCH: Well, it's three or four
sentences.
MS. McCLAIN: It's just difficult to
listen --
MR. DIEDRICHS: Why don't you just read
that in --
MS. McCLAIN: If you could just read it,
yeah.
MR. DIEDRICHS: Yeah, just read that into
the record, please.
MR. BUNCH: Okay.
MS. McCLAIN: Thank you.
MR. BUNCH: Well, why don't we just put
0096
it into the record as an excerpt. I can do that.
Actually, we'll make it even simpler. I
don't really feel like reading. This is Administrative
Record Page 20267, the final full paragraph.
BY MR. BUNCH
Q. So just to be clear, you don't see anything
there that you would --
A. No. I would agree with it.
Q. -- disagree with?
A. No. I would agree with that. I read the
entire page and put it in context. That's why --
Q. Okay.
A. -- it took so long. I'm sorry.
Q. Would you add anything?
A. No. I think it's well written and on point.
Q. Okay.
MS. McCLAIN: I'm not sure whether to
object to nonresponsive because I don't want to pin this
on you, but we still don't know what it says. So just
for the record, at this time we can't really follow the
conversation because we don't know what it says.
MR. BUNCH: Okay. You're welcome to read
it.
MS. McCLAIN: Thank you.
BY MR. BUNCH
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Q. Is Dr. Woodruff generally a reputable scientist
in this community?
A. Yes. I think he's very well-respected. He's

written some very good papers on the Edwards Aquifer. I've read some of those. I'm certainly not aware of his entire body of work, but what I've read I thought was very good and I think that he has a very good reputation among hydrogeologists in Texas.

Q. Okay. That said, though, he's not really one of -- a dye tracer specialist like yourself.

A. I'm not aware --

Q. Is that correct?

A. I'm not aware of him having done any dye tracing.

MR. BUNCH: Okay. All right. Thank you. Pass the witness.

EXAMINATION

BY MR. DIEDRICHS:

Q. Sir, my name is Clayton Diedrichs. I'm with the U.S. Attorney's Office here in San Antonio, and I represent the Federal Highway in this case.

I just have some basic questions. Can you tell me what, if anything, you did to prepare for today's deposition?

MR. BURKHALTER: You know what, Clayton?

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I'm sorry, but let me interrupt just to avoid any confusion. You had submitted a --

MR. DIEDRICHS: Cross notice.

MR. BURKHALTER: -- cross notice and had requested documents as part of that. And just to sort of close the loop on that, we had filed a motion to quash and I believe we've agreed -- you and a partner of mine have agreed that you're no longer pursuing the documents that you requested in that list that you sent along with your cross notice of deposition and we have made some documents available to you for your inspection. And I think we're -- I just want to get on the record that we're good on what you were requesting and what we have provided in response.

MR. DIEDRICHS: Right. I'm not requesting anything through the cross notice today.

MR. BURKHALTER: Okay.

MR. DIEDRICHS: That doesn't mean I won't request them in the future.

MR. BURKHALTER: I understand.

MR. DIEDRICHS: And I do have some questions with respect to some of the things that I asked. Certainly if you have any objections, you can interpose them.

MR. BURKHALTER: Sure.

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MR. DIEDRICHS: But I won't be requesting any additional documents today.

BY MR. DIEDRICHS

Q. And I'm sorry for that, but can you tell me what, if anything, you did to prepare for today's deposition?

A. I was asked to review my email notices, see what discussions or emails I may have had with folks

that -- people that may be associated with this lawsuit. The only two people I know who are involved with those members is a women named Annalisa Peace and then Bill Bunch, and I checked my emails and I do not have any emails related to this project either in my inbox or in deleted nor have I sent any emails.

Q. Did you have any other written correspondence?

A. None that I could find, no.

Q. What about with individuals from Save Our Springs Alliance, Texans Uniting for Reform and Freedom or Aquifer Guardians in Urban Areas?

A. To be honest with you, I don't know. People could have emailed me and I don't know who they're associated with.

Q. Sure.

A. But as far as I know, to the best of my knowledge I haven't really had a discussion related to the 281 toll road with anyone.

Q. Okay. What about the 1604?

A. 1604?

Q. Well, part of the allegation is that the 1604 project should also be part of this. Have you had any discussion --

A. No.

Q. And I understand you don't always know who you're talking to --

A. Right.

Q. -- or where they come from at least, but at least as far as you're aware?

A. I think it's pretty safe to say -- I'll be honest with you, other than reading in the newspaper a few articles that I get, basically clips because we have a clipping service that deals with any article on the Edwards -- they came through and I probably have read those. And again, it's more of a newspaper account rather than any sort of specific reports --

Q. Okay.

A. -- or emails.

Q. Have you received any documents from anybody associated with either of those three groups I just listed?

A. I have received a document from Annalisa Peace, but it wasn't related to this project. It was related to another project. And to be honest with you, I didn't open it or read it.

Q. Okay. Prior to the deposition did you review any documents at all?

A. Oh, yeah. That's all I do.

Q. No --

A. Are you saying related to this?

It's the story of my life. You study geology and you end up shuffling papers.

Q. Sure.

A. No, I really haven't.

Q. Okay. Dr. Veni's name has been mentioned

several times, and you've indicated that you have some history with him. You went to the same school or something?
A. He was one year behind me in the master's program, correct, and then I've known him professionally since that time period, which was probably '82 or '83.
Q. Did you know him while you were in school?
A. Yes. He had an office down the hall.
Q. And I understand, although I haven't seen your resume, that there is an article on there that both of you had published together?
A. Uh-huh. Probably more than one actually, but I

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couldn't tell you how many without counting.
Q. Are you working on anything with him currently?
A. I am a member of his board of directors. So I've served on the board of directors for the National Cave and Karst Research Institute for a couple years now and actually served on it before he was the director and was appointed as a director by his predecessor. And so he has been hired by the board since that time period, though I did not really have any involvement with his hiring. That was done by the executive committee.
Q. And when you say "his board", you mean the National --
A. Well, the National Cave and Karst Research Institute. Technically the board is an advisory board to -- I'm using the acronym for that group called NCKRI. NCKRI technically actually is an institute within National -- excuse me -- within the New Mexico Institute of Technology.
Q. And I'm sorry. You mentioned the year that you were appointed to that board. What year was that?
A. It's been about two and a half years, I think. To be honest with you, I don't know the exact date.
Q. And how long has he been the president of that?
A. I want to say a year and a half maybe.
Q. Okay.

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A. A year, year and a half.
Q. Do you consider him a friend?
A. Yes, and colleague.
Q. Certainly.
MR. DIEDRICHS: That's all I have, sir. Thank you.

EXAMINATION

BY MS. McCLAIN:
Q. I'm Lisa McClain. We met earlier, and I represent TxDOT in this case. I'm with the Office of the Attorney General and I have some questions similar to the type Clayton asked, just some things to clear up. And I have a few exhibits that I want to go over and a couple that we used earlier as well.
The first one is Exhibit 3, Schindel Exhibit 3, and again it's the open records request that was sent this June and the response, which basically says you guys didn't have any documents. Would you

necessarily be the point of contact for the types of documents that were sought here; that is, if TxDOT or its consultants were seeking comments from the Edwards Aquifer Authority, would those go to you?
A. They would go through our records person first, and then they would disseminate that request out to determine who would have relevant documents.

Q. Okay. And in this type of document that's sought here, any correspondence from TxDOT or its consultants about a project, what's the retention policy on something like that? Are you required to keep those?
A. You'd have to ask the records person for the answer.
Q. Okay. And then the next exhibit I wanted to talk about was Schindel Exhibit 2 and this is the two different pages, one of which is the 2001 email from Judy Friesenhahn to some other folks at TxDOT about meeting with you guys, and then I guess the meeting agenda notes that are written on there.
A. Right.
Q. So this is dated 2001, and I believe you said you think you attended the meeting since your card is stapled to --
A. Yeah.
Q. -- that, right?
A. I don't recall any details about it. And to be honest with you -- who was the meeting with, Judy Friesenhahn?
Q. Well, she's the one who wrote the email and it mentions Robin Tremallo, I guess, John Hoyt and you.
A. Other than Barrlynn West I probably couldn't recognize any of these people.

Q. But the date on this is May 10th of 2001, correct?
A. Correct.
Q. So at least as far as we can tell, you guys have known about the project itself since 2001, if not before?
A. Uh --
Q. The 281 project. Let me be specific.
A. Okay.
Q. Do you agree with that?
A. Yes.
Q. Okay. Third, let me ask you: Are you aware of -- I think one of the things you said actually as follow-up to that was that you think there could have been later coordination meetings because Mr. Bunch had pointed out on the agenda that Roman numeral II talks about coordination of information and notification on 281. So as far as you know there may have been some additional meetings?
A. There may have been. I may or may not have been involved in them. I certainly don't recall.
Q. Okay. And so are you aware of a meeting then that was conducted on February 13th of 2006 about the

281 project?
A. No. I don't think I was there.

Q. And let me pass this down to you.
MS. McCLAIN: And I apologize. I don't have additional copies.
BY MS. McCLAIN:
Q. But what this is, it's a coordination list that I will ask you to look at.
A. Okay.
Q. And just tell me do you recognize that document.
A. I do not.
Q. Can you just tell me what the document says at the top for the benefit of everyone here?
A. "Draft - Confidential Attorney Client Communication".
Q. Below that, please.
A. "Prepared at the Request of the Office of the Attorney General".
Q. Below that. What's the title of the document? Sorry, not the disclaimer at the top.
A. All right. "US 281 - Loop 1604 to Borgfeld Road Contacts for Agency Coordination Letters".
Q. Okay. And that document's been marked as Exhibit 10 and it's included in the administrative record for this project, and do you see the Edwards Aquifer Authority anywhere on either of those two pages

listed --
A. I notice --
Q. -- as contacts?
A. -- that Mr. Robert Potts' name is on this.
Q. And who is Robert Potts?
A. He was the former general manager of the Edwards Aquifer Authority.
Q. Okay. Thank you.
And let me ask you: Do you know -- we were talking earlier about the Edwards Aquifer rules, the 213 rules that TCEQ has published. And then you-all, of course, have your own rules. Do you know of any rules that require coordination with TxDOT in highway projects?
MR. BURKHALTER: With the EAA? Coordination --
MS. McCLAIN: Yes.
MR. BURKHALTER: -- with the EAA?
MS. McCLAIN: Yes.
A. Specifically require that?
BY MS. McCLAIN
Q. Uh-huh.
A. The only document that would come to mind that might be relevant would be the sole source aquifer designation requirement, and then I'm -- I really

haven't read that in many years so I'm not exactly sure what it requires.

Q. Is that something put together by EPA?
A. It's U.S. EPA Source Water Designation Program, and I think it requires that federal moneys -- in the event of the expenditure of federal moneys that the sole source aquifer designation be taken into consideration.
Q. Right, be taken into consideration. But as far as you know are there any rules that specifically require TxDOT to involve the EAA in its deliberations when it's preparing environmental documents?
A. I'm not aware of any.
Q. Okay. Thank you.
Okay. Do you know who Leigh Starlin is?
A. I think he was the lead singer for the Seldom Seen.
Q. Maybe I'll try that again.
First of all, it's a woman. Do you know who that is? She worked at this agency.
A. Oh, yes. Yes, I do.
Q. Do you know if she still works here?
A. She does not.
Q. What was her job when she was here? Do you know?
A. She was working on water quality issues and

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coordination issues, I think, inspections for WPAP's and that. I think she stayed maybe six months and then left.
Q. Okay. And I'm going to pass this document to you as well to see if you recognize this, if you would. It's been marked as Exhibit 11.
A. Yeah.
Q. And if you'll just let me know if you recognize it and then please identify it for me. And if there's a disclaimer at the top, you can leave that off this time just so you don't have to read that again.
A. Okay.
Q. I don't think there is but ...
A. It's a Texas Department of Transportation US 281 from Loop 1604 to Borgfeld Road Citizens Sign-in Sheet. And I do recognize Leigh Starlin, her name here. I don't know the date on this so I don't know when she was -- well, actually, the date on this is Public Hearing February 6, 2007. I don't believe she was employed at the agency at that time.
Q. Okay. Thank you.
Let's see. I've got one more document I'm going to pass down to you if you would have a look at it for me. I'll pass it through everybody else, and if you'll just take a look at it and see if you

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recognize that and then let us know what that is. And there is no disclaimer on the top of that one.
A. Okay. Okay. It's a record of conversation.
Q. And who is that between and what's the date, please?
A. Kemble White to Mr. John Hoyt of EAA Resource Protection Department, a phone number, Project

Name/Number: 281 and 1604 groundwater tech reports.
Q. Okay. And can you just give us a quick summary of what that paragraph says, if you've had a minute to read the note of that phone call?
A. I'm sorry. Do you want me to read this?
Q. I'd like for you -- you can read it to yourself.
A. Okay.
Q. And then just tell us generally what it says, if you would.
A. (Complying) All right.
Okay. This -- and you want me to basically paraphrase this?
Q. Well, if you'd like. Or what does it -- what do you see when you read that?
A. It looks like a record of conversation between Kemble White and Mr. John Hoyt related to known karst features and other water quality issues related to the

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area around 281 and 1604.
Q. And do you know Kemble White?
A. I have met him, yes.
Q. And what does he do?
A. I believe he's a consultant. Last I knew I think he works for SWCA.
Q. Okay. And is he a karst specialist, or do you know what kind of work he does specifically?
A. My understanding is he's mostly related to endangered species issues.
Q. Okay.
A. I don't know his -- you know, what his qualifications are specifically related to --
Q. Sure.
A. -- this.
Q. And what does Mr. Hoyt do again? I'm sorry. I know we talked about him earlier.
A. Mr. Hoyt's my supervisor. He's the deputy general manager with the agency --
Q. Okay.
A. -- and he is in charge of the aquifer management program.
Q. Okay. So as far as that email -- or, pardon me, that note of conversation reveals, it's just a conversation between a couple of professionals about

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various water quality issues in the 281 project area. Is that correct?
A. Correct.
Q. Okay. Thanks.
Let's just talk very briefly about the Environmental Assessment review. I think you had said that that's something that your general manager would decide, whether to comment or not on an environmental assessment if requested to do so by TxDOT or any other agency?
A. Correct.
Q. Okay. And how many EA's or, excuse me,

Environmental Assessments do you think the Edwards Aquifer Authority's reviewed in the past, say, three years?
A. I don't know that.
Q. But you said it's not uncommon. Is that right?
A. Well, it's not uncommon for us to be requested to review documents and/or provide input or something to a particular process.
Q. Okay.
A. So we cooperate on many different levels with other agencies.
Q. And you mentioned that you've got interlocal agreements with certain agencies. Is that right?

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A. Where we have specific projects, ongoing projects.
Q. Do you have any with TxDOT?
A. I do not know that.
Q. And is tracer testing something you've done before for TxDOT? I know that was a question that was posed.
A. As far as I know, we -- let me think -- as far as I know, I have not done any tracer testing with TxDOT.
Q. Okay. And just to --
A. Never been asked.
Q. Okay. Thanks.
And to be clear then, you said you have not read the U.S. 281 Environmental Assessment in this case?
A. No, I have not.
Q. And you have not read any of the technical reports. Is that correct?
A. I have not.
MS. McCLAIN: Okay. That's all I have. Thank you.
I'll pass the witness.
MR. BURKHALTER: Lisa, you have -- excuse me for interrupting, but we went from Exhibit 11 to

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Exhibit 14.
MS. McCLAIN: I pulled a couple.
MR. BURKHALTER: Okay.
MS. McCLAIN: I pulled a couple out that I meant to skip so I'm sorry for the confusion.
You can straighten that up.
Thank you.
MR. BURKHALTER: Sure.
MS. WINLAND: I'll be quick.

EXAMINATION

BY MS. WINLAND:
Q. I'm Lori Winland. I'm an attorney with Locke, Lord Bissell & Liddell. We represent the Alamo Regional Mobility Authority, one of the other defendants in this case.
Are you familiar with the members of the Edwards Aquifer Authority's board of directors?

A. Yes, I've met them all.
Q. Okay. So -- and are Enrique Valdivia and George Rice both on the board?
A. Yes, they are.
Q. Are you aware that those two gentlemen serve as officers of Aquifer Guardians in Urban Areas?
A. I did not know that.
Q. Okay.

MS. WINLAND: That's all I have.
MR. BUNCH: One more question.
FURTHER EXAMINATION
BY MR. BUNCH:
Q. From a concern about pollution, would that extend to the contributing zone up into Comal County as well?
A. Yes, it would.
Q. Can you just sort of explain why?
A. The contributing zone is called the contributing zone because it contributes water to the Edwards. Generally the thought is that water collected out on the contributing zone where there are -- units are less permeable than the Edwards basically are collected through surface water processes, basically water flows into the streams and as they flow downstream towards the Gulf of Mexico they cross over the Edwards limestone, the recharge area, and many of those streams lose some or all of their water into the Edwards.
In addition, our tracer testing -- let me back up and say the conventional wisdom was that these units do not communicate. The Trinity Aquifer, which is composed of upper, lower Glen Rose formations and some other formations lower that aren't really important to this conversation, those units do not actively

communicate water between those units and the Edwards limestone. Our tracer testing indicates that that's incorrect in northern Bexar County, and we do have examples where we have traced -- used tracers to trace from the upper Glen Rose limestone directly into the Edwards limestone. It's called interformational flow. And we've documented that three or four times now.
MR. BUNCH: Okay. Thank you.
MR. DIEDRICHS: I have one follow-up question.
FURTHER EXAMINATION
BY MR. DIEDRICHS:
Q. Are you aware of anybody here at the EAA who is either a member or associated with any of the plaintiffs here, S.O.S., Aquifer Guardians or TURF?
A. No, I don't know of anybody.
Q. Okay.
A. I know that I, you know -- go ahead. I'm sorry.
I -- you know, some of those groups have a very broad email list and they send out notices about some item or something going on and that, but you

know -- so I seem to be on one of those lists anyway. I generally -- I don't think I've ever attended any of their meetings personally. I don't know of anybody else who has.

Q. Or who is a member of those groups at all?

A. Yeah. But, you know, for that matter, we could have members of the Ku Klux Klan here, I wouldn't know that.

Q. Just asking what you know.

A. I don't ask.

MR. DIEDRICHS: All right. Thank you.

MR. BUNCH: I think we're done. Thank you very much, Mr. Schindel.

(Deposition concluded at 2:48 p.m.)

CHANGES AND SIGNATURE

PAGE	LINE	CHANGE	REASON

I, GEARY M. SCHINDEL, have read the foregoing Oral Deposition and hereby affix my signature that same is true and correct, except as noted above.

_____

GEARY M. SCHINDEL

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STATE OF TEXAS)
COUNTY OF _____)

Before me, _____, on this day personally appeared GEARY M. SCHINDEL, known to me (or proved to me under oath or through _____) to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that they executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this _____ day of _____, 2008.

_____
Notary Public in and
for the State of _____

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STATE OF TEXAS)
COUNTY OF BEXAR)

REPORTER'S CERTIFICATE

I, MICHELE W. KUHLMANN, a Certified Shorthand Reporter duly licensed and qualified in and for the State of Texas, do hereby certify that pursuant to notice duly issued there came before me on the 7th day of August, 2008, from 11:03 a.m. to 2:48 p.m., at the Edwards Aquifer Authority, Inc., 1615 N. St. Mary's Street, San Antonio, Texas, the following named person, to wit: GEARY M. SCHINDEL, who was by me duly sworn to testify the truth and nothing but the truth of his knowledge touching and concerning the matters in controversy in this cause; and that he was thereupon examined upon his oath and his examination reduced to writing under my supervision; that the deposition is a true record of the testimony given by the witness, same to be sworn and subscribed by said witness before any Notary Public, pursuant to the agreement of the parties;

That the amount of time used by each party at the deposition is as follows:

MR. WILLIAM G. BUNCH - 2 hours, 15 minutes
MR. CLAYTON R. DIEDRICHS - 0 hours, 20 minutes
MS. LISA McCLAIN - 0 hours, 12 minutes
MS. LORI FIXLEY WINLAND - 0 hours, 1 minute

I further certify that I am neither attorney nor

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counsel for, related to, nor employed by any of the

parties to the action in which this testimony was taken, and further that I am not financially or otherwise interested in the outcome of the action.

SUBSCRIBED AND SWORN to on this the _____ day of _____ , 2008.

_____
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