STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

Case No. 10288

IN THE MATTER OF CASE NUMBER 10288)
APPLICATION OF PHILLIPS PETROLEUM)
COMPANY FOR A PRESSURE MAINTENANCE)
PROJECT, EDDY COUNTY, NEW MEXICO)

REPORTER'S TRANSCRIPT OF PROCEEDINGS
EXAMINER HEARING
BEFORE: JIM MORROW, HEARING EXAMINER

Friday, April 18, 1991
8:40 a.m.
Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Division on April 18, 1991, at a hearing beginning at 8:40 a.m., at Morgan Hall, State Land Office Building, 310 Old Santa Fe Trail, Santa Fe, New Mexico, before: Gail D. Vinson, CCR, Certified Court Reporter Number 297, for the State of New Mexico.

FOR: OIL CONSERVATION DIVISION

BY: GAIL D. VINSON, CCR
Certified Court Reporter
CCR No. 297

I N D E X

April 18, 1991
Examiner Hearing
Case No. 10288

E X H I B I T S

A P P E A R A N C E S

FOR THE DIVISION:	ROBERT G. STOVALL, ESQ. General Counsel Oil Conservation Commission State Land Office Bldg. 310 Old Santa Fe Trail Santa Fe, New Mexico 87501
FOR PHILLIPS PETROLEUM:	KELLAHIN, KELLAHIN & AUBREY Attorneys at Law BY: W. THOMAS KELLAHIN, ESQ. 117 N. Guadalupe Santa Fe, New Mexico 87501

EXAMINER MORROW: I would call Case Number 10288.

MR. STOVALL: Application of Phillips Petroleum Company for a pressure maintenance project and a special oil producing allowable therein, Eddy County, New Mexico.

MR. KELLAHIN: Mr. Examiner, I'm Tom Kellahin of the Santa Fe law firm appearing on behalf of The Phillips Petroleum Company. I have one witness to be sworn.

JEFF HARGROVE

was called as a witness, and having been first duly sworn, was examined and testified as follows:

MR. KELLAHIN: Mr. Examiner, my witness is Mr. Jeff Hargrove. Mr. Hargrove is a petroleum engineer with Phillips Petroleum Company. He resides in Odessa, Texas.

EXAMINER MORROW: Hargrove?

MR. KELLAHIN: H-A-R-G-R-O-V-E.

EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Hargrove, for the record would you

please state your name and occupation?

A. My full name is Geoffrey Scott Hargrove. I'm a reservoir engineer for Phillips Petroleum Company in the Permian Basin area, based in Odessa, Texas.

Q. Mr. Hargrove, would you summarize for us your educational background?

A. I have a bachelor's degree in petroleum engineering from the University of Missouri at Rollin.

Q. In what year, sir?

A. I graduated December 1989 -- 1988. I started working for Phillips in January of '89.

Q. What duties do you have with regards to your company's activities and what is described as the Cabin Lake-Delaware Pool, particularly on the James "A" State Lease in portions of Section 2, Township 22 South, Range 30 East of Eddy County, New Mexico?

A. As a reservoir engineer over that property?

Q. Yes, sir.

A. I'm basically -- my job is to develop the oil and gas reserves.

Q. As part of that study have you made an

engineering investigation of the feasibility of instituting pressure maintenance for a portion of that lease?

A. Yes, sir, we have.

Q. And based upon that study, have you reached certain engineering conclusions about the feasibility of that pressure maintenance project?

A. Yes, sir.

MR. KELLAHIN: We tender Mr. Hargrove as an expert petroleum engineer.

EXAMINER MORROW: We accept his qualifications.

Q. (By Mr. Kellahin) Let me direct your attention, sir, to what is marked as Exhibit Number 1, that's the area plat. Take a moment and help orient the Examiner to where you are with your particular project. Can you tell us where you are in relation to the City of Carlsbad?

A. We're approximately 29 -- 29 and a half miles east of Carlsbad, 22 and a half.

Q. We're in Eddy County, New Mexico?

A. Eddy County, New Mexico.

Q. And this Cabin Lake-Delaware Pool?

A. Uh-huh.

Q. That's the name of the pool?

A. Yes, sir. It consists of the Bell, the Cherry and the Brushy Canyon formations.

Q. The area shown on Exhibit Number 1 is the area utilized by you to investigate the half mile area of review for your C108 proposal for the division?

A. Yes, sir.

Q. And you've also used it to scribe the two mile radius circle?

A. We used a separate page to define the area of review.

Q. Let's talk specifically about the area involved in the James A lease and let me direct your attention to Exhibit Number 2. What are the kinds of wells we're looking at here?

A. All the wells within the area of review as outlined by the circle are produced from the Delaware formation except for the Number 1 well. It's a gas well that produces from the Pennsylvanian Strong.

Q. When we look at Section 2 there is a black arrow that identifies an open well location, it says W-1, what is that intended to represent?

A. The proposed well location for the W-1, from an aerial point of view. It's basically in the

center of the proposed project area. The proposed project area is outlined by the four producing wells that surround the W-1, the James A 2, the James A 5, the James A 6, and the James A 7.

Q. As part of your engineering study, Mr. Hargrove, what did you, in fact, study?

A. We examined the present production data and pressure data for the Cherry Canyon formation and the proposed project area. We determined that we're probably producing reservoir pressure close too bubble point within one or two years. We feel at that point that our critical gas saturation will be exceeded and we'll lose a large portion of our solutions gas drive. And we expect the production to decline rapidly from that formation.

Q. Having examined the performance of your wells in this immediate area, what have you recommended to your company in terms of maintaining reservoir pressure and extending the producing life of your Cedar Lake-Delaware Pool well?

A. Cabin Lake?

Q. Cabin Lake.

A. I'd like too institute, like Mr. Kellahin mentioned, a pressure maintenance project. By drilling the James A W-1, basically

what we want to do here is maintain reservoir pressure above bubble point.

Q. Why have you picked this particular location within your lease to locate the injector well?

A. This is a very advantageous location because the James A 2, 5 and 6 are all presently completed in the Cherry Cherry Canyon. I mentioned before that the Delaware consists of the Bell, the Cherry, and the Brushy Canyon. At this point the Cherry -- it's been proven that the Cherry Canyon and Brushy Canyon sandstones -- different sand stone channels are productive.

The Cherry Canyon is only developed in these three wells. We had good data. We cored two of the Cherry Cherry intervals in the 6 and 7. We have reservoir fluid analysis from the Cherry Canyon formation, crude oil, and the James A 2. So this was an ideal location to model the reservoir performance of the Cherry Canyon because we had the good data. It's -- as well as the rest of these wells aren't completed in the Cherry Canyon formation.

Also, it's an ideal location, it's very close to our tank battery for the James A State

lease. So, basically, we had three good reasons. Three of the four wells were already completed in the formation. We had good data to go by, to determine if it was going to be economically feasible to execute the program and it's in a good location for our operations.

Q. Having determined that the portion of the lease is suitable for pressure maintenance, have you determined what initial operation criteria you need approval from the division for, in order to institute the pressure maintenance project?

A. We would like, and request, an allowable injection rate of 2,000 barrels per day. We came to that number -- well, we'd like an injection rate of around 2,000 barrels per day. And we would like a project allowable for the project area --

Q. Let's talk about the allowable.

A. Okay.

Q. What is the depth bracket allowable for each of your Cabin Lake Delaware Pool wells?

A. Okay, the James A 2 was a discovery well for the pool in this field. It has 146 barrels of oil a day allowable. The James A 5, 6, and 7 have 107 barrels of oil per day allowables.

We would like a project allowable of the

sum of those four figures, and also the flexibility to produce that sum with any combination of production from the four wells. I think that sum comes up to 467 barrels of oil per day.

Q. Have you made a calculation of the voidage replacement factor that you're recommending to the Examiner for inclusion in the order?

A. Yes, sir.

Q. And what is that number?

A. 1.2.

Q. What would be the purposes of having a voidage replacement factor integrated into the order, Mr. Hargrove?

A. (No response.)

Q. Well, it let's you maintain reservoir pressure, doesn't it?

A. Well, it gives us an idea of how much, yeah, of what volume of water we need to reinject from an reservoir engineering standpoint. It gives us a ball park number of what we're going to take to reinject, to replace one reservoir barrel of voidage.

Q. What number have you come up with that you recommend to the Examiner that he utilize for this voidage replacements factor?

A. What volume of surface water is there? Two thousand barrels per day.

Q. Have you -- in terms of a one-to-one or one percent to some other number, what is the number?

A. One barrel -- 1.2 barrels injected to one barrel recovered at the surface -- of total oil and water.

Q. So for every barrel of reservoir fluid removed from the reservoir at the surface you want to reinject 1.2 barrel of water back into the reservoir?

A. Actually, we equated-- equated that from a reservoir standpoint. For every barrel of water -- every barrel of fluid recovered at the surface, we want to reinject 1.2 barrels.

Q. Why?

A. To replace one barrel of reservoir voidage with another barrel of reservoir voidage. What we did is we looked -- if we produce all four of these wells in this project area, at the 467 barrels a day allowable with the current water-oil ratios, we equate that volume to reservoir volumes, using a Oil Commission volume factor of 1.3, water formation volume factor of 1.0.

To replace that we're going to have to reinject -- we want to reinject the same volume of reservoir fluid we removed. So we calculate -- we take that volume and bring it to the surface.

What that did is we produce all four wells at their allowable with existing water-oil ratios. We're going to remove approximately 1850 barrels of water -- reservoir barrels per day from the project area. We want to replace that with 2,000 barrels of water, surface water, and that's 150 more than what we're going to replace.

But the Cherry Canyon formation, only 50 feet of the 110 feet channel is productive. The entire channel is going to take water, the permeability crossing five channels is very consistent, and to effectively flood the productive zone, it's going to take -- we're going to have to -- the entire channel will take the water.

So we wanted 150 barrels of water more to effectively flood the entire channel, the hydrocarbon and nonhydrocarbon portions of it. That came up to 2,000 barrels a day, equated that with what we're going to recover, and that's how we got our recovery -- this -- that's the voidage for efficient reinjection, 1.2.

Q. In order to assure that the fluids introduced into the pool, and particularly into this Cherry Canyon member of the pool, stays confined to the pool interval, are you proposing the Examiner use the .2 psi per foot a depth guideline subject to subsequent step rate tests to increase that pressure limitation?

A. Yes, sir, I would do that and then run a step rate test and determine what a fracture pressure is. If the rate from the step rate test is less, make that the maximum allowable injection rate.

Q. If the project determines -- if subsequent operation under this plan for this project determines that you're going to conserve reservoir pressure, you're going to increase the life of the project, and you later want to expand the project, are you asking the Examiner that he include an administrative procedure for the expansion of the pressure maintenance project so that it might include other wells within this same reservoir?

A. Yes, sir.

Q. Have you prepared production decline curves to analyze, and then project in forecast

performance under pressure maintenance operations for the project area?

A. Yes, sir. That's on Exhibits 3, 4, 5 and 6.

Q. All right. Let's identify 3, 4, 5 and 6 and then we'll come back and talk about each of those displays. What does Exhibit 3 represent?

A. Exhibit 3 is a composite production plot of the James A 2, 5 and 6. I excluded the James A 7 because, as I mentioned earlier, the James A 7 is completed in a different zone, and not the Cherry Canyon. And --

Q. We have the James 7 down in the Brushy Canyon, it's still in the same pool?

A. Right, yeah.

Q. But you don't have a completion in that well bore in the Cherry Canyon for comparison?

A. No, sir. And these plots were made to help model, so we left the James A 7 out.

Q. So when we look at Exhibit 3 that is a compilation --

A. Uh-huh.

Q. -- of the production information from wells 2, 5 and 6?

A. Yes, sir. And --

Q. And then after that, Exhibit 4 represents the James A Well Number 6?

A. Uh-huh.

Q. Number 5 is the James A Well Number 5?

A. Uh-huh.

Q. Exhibit 6 then is the James A Well Number 2?

A. Yes, sir.

Q. Let's go back to the compilation page, Exhibit 3. What does that show you as a reservoir engineer?

A. Of course these wells were drilled at different times, and this is a composite plot, so we don't really -- I think the James A Number 2 was completed in early 1987, the James A Number 5 was completed in late 1988, and the James A 6 was completed in early '89. Which kind of explains the erratic profile.

I really started looking at it -- the composite plot in early '89 through late '90. You see a dip in the production of the oil production curve in late '90. Those represent some operational problems we had out there. What we basically used this data that for was -- it was a matching point. We took --

Q. Let's talk about that. With preliminary information in a short producing interval for Cherry Canyon in these three wells, you had to resort to some type of reservoir simulation in order to model the anticipated performance of these wells with and without pressure maintenance?

A. Yes, sir.

Q. And how did you forecast then the occurrence of pressure maintenance in these wells?

A. We ran the model for 10 years with a -- one with pressure maintenance and one without pressure maintenance. But with pressure maintenance we instituted an injection well injecting 500 barrels of water per day. Because that's what we expect the Cherry Canyon is going to take.

Q. Let's go then to the forecasted performance using the modeling results and have you describe Exhibit Number 7 and show us what that tells you?

A. Okay.

Q. So let me have you turn to Exhibit 7 at this point. Before you talk about the results, help us understand how to read the display.

A. This is just a profile of years

cumulative production, start in 1991. These are forecasted. The green profile is a forecast of if we continue to operate this Cherry Canyon as is, without instituting a pressure maintenance program.

The blue profile is with the pressure maintenance program. On the Y axis, or the vertical axis, our years cum. production from the Cherry Canyon formation within that 35 acre project area.

Q. Okay.

A. And as a reservoir engineer, what I'm seeing here is, if we continue to deplete the Cherry Canyon formation, we reduce the reservoir to at or below bubble point within what looks like two years.

At that point you can see that oil production -- the model forecasts that our production will decline somewhat rapidly because it's a solution gas drive reservoir there is no water encroachment. It's not a gas cap. There's no free gas cap. The only drive mechanism is a solution gas drive.

Once we do deplete it below bubble point, we do lose a lot of it, reach a different gas

saturation, and that's what the model is predicting there. By instituting a pressure maintenance program, we maintain that reservoir pressure at or above bubble point. We keep the energy in the oil, and we maintain our one and only drive mechanism which is solution gas drive.

Q. In terms of the timing of the institution of pressure maintenance, is now the optimum time in which to continue to try to preserve reservoir pressure through pressure maintenance?

A. Yes, sir, that's why we're here today.

Q. Have you estimated under these assumptions the incremental oil that may be recovered under a pressure maintenance project for this project area?

A. Yes. For the project area the 35 acres, the model calculated in incremental --

Q. I'm sorry. Slow down a little bit.

A. -- the amount of what, for the project area, the 35 acres, the model calculated in incremental recovery of 124,000 barrels of oil, which is the Cherry Canyon formation.

Q. Okay. Let's look at Exhibit Number 8 and have you tell us the reservoir parameters that you used to model the performance of the project

area?

A. Okay. The formation that we used -- that we modeled is the Cherry Canyon. Let me go ahead and state that we want to inject -- we want to inject in all the formations in the Cherry and in the Brushy Canyon.

To justify it economically, we just modeled the Cherry Canyon because that's where we had the good data that we felt that we could accurately model it and stand up here and testify on. That's the only formation we had good enough data to do this. The depth of the Cherry Canyon is approximately 5600 feet.

Q. That's the approximate top of the Cherry Canyon --

A. Yes, sir.

Q. -- in the wells? But you don't propose to have your project limited only to the Cherry Canyon?

A. No, sir.

Q. You anticipate to have the opportunity to expose the entire vertical limits of that pool to the water introduced by the injector well?

A. Uh-huh, from the Brushy Canyon -- from the Cherry Canyon down to the Brushy Canyon, all the

productive sand stone channels. There's a multitude of productive zones. The one we've discussed mostly here is the Cherry Canyon, and that's the one that's completed in A 2, in A 6 and A 5 wells.

Q. Do you see any adverse consequences of doing that, of having approval to flood the entire zone?

A. No, sir.

Q. It will help you preserve reservoir pressure, will it not?

A. Uh-huh.

Q. As you open up additional zones within the pool and starts depleting the Brushy Canyon or other intervals in the Delaware, and you can maintain pressure if you're introducing water through the entire potential oil column in that pool?

A. That's the basic concept.

Q. The source of the information then for the parameters, you have your formation, you have your depth. We've talked about the acreage. The thickness, I assume, came off of log analysis?

A. Yes, that thickness represents the net pay of the Cherry Canyon channel, what is hydrocarbon, what has commercial quantities of

hydrocarbon.

Q. Where did you get your permeability range?

A. The permeability came from special core analysis conducted on the James A 6 and James A 7 wells.

Q. That's two of the wells in the project area?

A. Right.

Q. Okay.

A. The Cherry Canyon was cored in both of those wells, and we conducted air permeability tests.

Q. Okay, what about porosity? What did that come off of?

A. From the neutron -- we had neutron logs run, open hole, compensated neutron logs. Oil saturation and water saturation were calculated from the open hole electric logs and run through the formation.

The initial reservoir pressure was derived from a build-up test on the James A Number 2 which was a discovery well for the field from the Cherry Canyon. The current reservoir pressure, again, is from some of the production and pressure

analysis we've done, and the geo -- the comparisons of our GOR, producing GOR, with that of reservoir fluid analysis conducted on the Cherry Canyon. Crude oil from the James A 2, which is in the project area.

The one injection rate of 500 barrels of water per day is what we expect of the 2,000 barrels. That was just a modeling parameter that we wanted to do to see what -- how the Cherry Canyon was going to perform. If we got full reservoir voidage replacement into the Cherry Canyon, we expected it would do much better. But we wanted to be conservative in our analysis so we only allocated 500 barrels injection into that formation.

Q. And at 500 barrels a day, you found that there was significant advantage to you in maximizing ultimate recovery from the Cherry Canyon?

A. Yeah. And this 500 barrels a day we model -- we only modeled the net pay of the channel and a little over half of this channel is nonhydrocarbon bearing.

Q. Let's turn to the cross-section then and go through that analysis. That's marked as Exhibit Number 9?

A. Uh-huh. This is an east-west cross

section. With the neutron density porosity logs for the James A 2, 5, 6 and 7 of the project area. I had highlighted on these logs what was the main productive portion of the channel. Physically --

Q. You're talking about the main portion of the Cherry Canyon --

A. Right.

Q. -- channel. It excludes other producing or potentially productive zones within the pool limits?

A. Yes, sir.

Q. We're just concentrating on that portion of the logs that was used to model the performance of pressure maintenance for the Cherry Canyon?

A. Yes, sir.

Q. Okay.

A. If you'll look at the James A 6 log. What I'm calling the Cherry Canyon was this individual channel of the Cherry Canyon. And if you will look at the gamma ray, there's a couple of peaks around 5670. And that's a very hot tight dolomite. That's basically the top that was what was the stratographic trap for this sand stone channel.

As you see the porosity develop, that's

the bulk of the channel and it comes down to about 57, 74. Approximately half of this channel -- there's an oil saturation throughout the entire channel. The cutoff is probably the top 40 or 50 feet and below 57 30, 57 40, the oil saturations are very low.

But this is just a cross section that's been correlated on depth. It looks like the James A 5, the bottom half of the channel has been cut off on the photocopy. But in the channel -- the channel starts to pinch out a little on James A 2, as you can see it -- it becomes -- these sand stone channels are turbadites and they burrow themselves -- they kind of pinch out laterally in the silt stones and sand stones, so the channels will pinch out.

Q. From the log analysis, though, are you able to reach the engineering conclusion that pressure maintenance is feasible for the Cabin Lake-Delaware Pool?

A. Yes, sir.

Q. Let me direct your attention now to the details of your C108, which you prepared. Let me have you pull out Exhibit Number 2, which is the half mile area of review map; do you have that?

A. Yes, sir.

Q. If you'll turn to Exhibit 10, that's the balance of the exhibits and displays that deal with the C108, do you have that? Do you have your exhibit?

A. Yeah, C108?

Q. Yes, sir. All right, let's talk now about the vertical limits for the pressure maintenance and where you propose to have approval to inject your water. Show us what your injection interval is going to be? I think if you turn to Page 3 of Exhibit 10, you have that information shown under Subparagraph B at the top of Exhibit Number 10, Page 3, it says "proposed injection interval." What are you proposing here?

A. We want to flood -- we've drilled a W-1. We'll run a -- we'll examine the logs, and my log analysis and open all electric logs. We will flood -- we expect to see the same productive zones that we saw in the four ceramic leasing wells in the project area.

We want to flood every productive sand stone -- Brushy Canyon and Cherry Canyon sand stone channel. We expect the depths -- the top of the Cherry Canyon to be around 5600 feet, and the base

of the last productive Brushy Canyon channel to be at approximately 7400 feet.

And this is just from the correlation of the logs in the project area.

Q. When we turn to Page 5 of that exhibit, what does that show you?

A. This is the proposed well bore sketch of the James A W-1.

Q. Have you satisfied yourself that that is to be completed as an injector well consistent with the requirements of the Oil Conservation Division?

A. Yes, sir.

Q. In examining for potential fresh water sands, did you find any, or did your geologists find any potential fresh water sands in the half mile area of review?

A. I consulted our geologist in that area. And the geologist -- he's the geologist over this Cabin Lake field. He says there is no fresh water sands in the Cabin Lake field area.

Q. Is there a geologic explanation to the absence of potentially producing fresh water sands?

A. The Ogallala --

Q. Yes.

A. -- fresh water reservoir doesn't extend

in the Cabin Lake Field. It's not there.

Q. Salt sections are high enough to the surface to omit the potential of having the Ogallala present in this area?

A. Yes, sir.

Q. To the best of your knowledge, there is no producing fresh water?

A. To the best of my knowledge.

Q. Okay. Even apart from that, though, have you examined within the half mile area to see if there are any flooded abandoned wells? Did you find any?

A. Yes, sir. Our James E, Number 2, if you'll look at Attachment Number 5, C108, and the area of review, you can see a slice right on the border that was one-half mile radius --

Q. That's from Page 8 of Exhibit 10?

A. Yes. Attachment Number 5 is a well bore schematic.

Q. Refer to it by the page number. That's Exhibit 10, Page 8.

A. Exhibit 10, Page 8.

Q. First of all, find it on Exhibit Number 2. Where is it?

A. It's in Section 11,.

Q. Southwest corner of the circle, right?
A. Yes, sir.
Q. What's the status of the well?
A. It's P and A.
Q. And are you, as an engineer, satisfied that it has been adequately plugged and abandoned?
A. Yes, sir. I don't think there's any chance of any injection water entering the well bore, channeling up any kind of annual -- sort of thing like that. I think it's effectively sealed. Any other productive formations have been sealed off. They shouldn't be a problem.
Q. When we look at the tabulation of producing well information within the area of review shown on Pages 6 and 7, is that information that you compiled yourself?
A. Yes, sir.
Q. In reviewing that information do you find any problem producing wells that would serve as a means by which injection fluids into the Delaware might migrate through that well bore and go to some other pool or zone?
A. No, sir.
Q. No problem there?
A. No, sir. All the wells are Delaware

wells. They're cemented above the Delaware. In the case of program, the James A 1 is a Pennsylvania Strong well, and it's been cemented to above the Delaware. There's no chance of the injection fluids going out of zone.

Q. And with no fresh water available in the area, you have no water analysis to present concerning the fresh water?

A. No.

Q. Let's identify the offsetting operators. Are there any other offsetting operators to this project area, other than Phillips Petroleum Company?

A. Not within the area in review.

MR.: Mr. Examiner, Exhibit Number 11 is our Certificate of Mailing of Notice of Hearing to the Commissioner of Public Lands. They own the surface at the proposed injection well locations.

That completes my examination of Mr. Hargrove. We move the admission of Exhibits 1 through 11.

EXAMINER MORROW: All right. We accept Exhibits 1 through 11 into the record

(Exhibit 1 through 11 were marked for identification.)

EXAMINATION

BY EXAMINER MORROW:

Q. Mr. Hargrove, on Exhibit Number 2, there are several wells, I think, all of them are Number 1's that are identified as gas wells. I believe one in Section 1 is the Strong well that you identified; is that correct?

A. In Section 1? Yes, there's an old abandoned -- it's a P and A, Bar Strong well. We picked up the well bore when we purchased the Livingston original lease.

Q. The wells in Sections numbered 2 and 11 that are identified as gas producing wells, where do they produce from?

A. The Number 1 is the only gas well. It produces from the Strong formation.

Q. Number 1 in Section 2?

A. Yes, sir. Oh, the Number 1 in Section 11 is a P-and-A Strong Morrow well.

Q. Now let's see, 2, 5 and 6 are Cherry Canyon producers; is that correct?

A. Yes, sir.

Q. And the other wells, tell me what they produce from?

A. All of the wells produce from different

sand stone channels of the Brushy Canyon.

Q. The rest of the wells in that circle are Brushy Canyon wells?

A. Yes, sir.

Q. There are no Bell Canyon producers at this time?

A. (Witness shakes head.)

Q. Number 5 outside the circle, does it produce from the Brushy Canyon?

A. Yes, two channels of the Brushy Canyon.

Q. And is the same true of wells numbered 3, 9 and 11, outside the circle?

A. Yeah. Number 9 produces from three channels. They all produce from several channels of the Brushy Canyon.

Q. The injection rate will be 2,000 barrels per day is what you're proposing, and that will replace the reservoir voidage that you expect to withdraw --

A. Yes, sir.

Q. -- is that correct?

A. Yes, sir, subject to a step rate test. We go in there and do a step rate test and see that we're fracturing one of the channels, reduce it accordingly so that we don't -- if it takes more

pressure than the fracture pressure to inject 2,000 barrels a day, we'd want to back off that.

And we'll conduct a step rate test as soon as we drill and complete the W-1. We would -- and determine if the pressure associated with 2,000 barrels a day of injection pressure -- see what the fracture pressure is so that we don't go out of zone. So that we --

Q. So that to determine that, you have to inject less than that. Would you withdraw less than that, also?

A. Yes, sir -- well, -- probably less. We would probably have some reservoir voidage that would go unreplaced.

Q. All right. Now, the allowable you requested, would you sum that up again for me. I didn't follow that.

A. Yeah. The project allowable?

Q. Yes.

A. We would like to make it the sum of the current well allowables for the four wells in the project area.

Q. The four wells or the three wells?

A. Well, we're going to-- the A 7, A 6, A 2, and -- A 2, A 5, A 6 acknowledged A 7.

Q. And 7 is --

A. We plan to complete it in the --

Q. It's not completed now, it's planned?

A. We plan to, yeah.

Q. And what would those allowables be, four times some number or --

A. The A 2 has allowable the 146 barrels a day, since it was the field discovery for that pool, the Delaware pool. The other three wells have depths-based allowables of 107 barrels a day. And if my math is correct, that's 467.

Q. 467, okay. And so you are going to withdraw 467. That will be somewhat more reservoir barrels. And is the rest of the 2,000 then, is that to account for the gas you withdraw and the water you produce?

A. Part of the 2,000 barrels will go into the Brushy Canyon but -- right, yeah. The way we came about that is we have a producing water ratio of about 2.67. I took this -- we have this project allowable with our existing producing water ratio. We convert that to reservoir barrels. That was the 1850 reservoir barrels that I mentioned. And that's what we need to replace, if we produce the wells at allowable rates.

Q. Did you say the formation^was, in fact, that you used was 1.3?

A. For the oil and 1.0 for the water.

Q. Will the injection be straight into the hydrocarbon portion of the pay, or will you put it below the oil-water contact?

A. We'll inject to the hydrocarbon portion of each channel. This is -- the sand stone channels are somewhat laminated, and that's going to help us staying in zone and within the channel itself.

But, undoubtedly, some of the water will migrate into the unprotected portion of the channel, and we won't have 100 percent efficiency. That's why I added 150 barrels a day for that, to account for that. That's where we arrived at 2,000. And then if you compared that to the volume of fluid to the surface, that actually comes up to 1.2.

Q. On Exhibit 7 was the thousand barrels of oil that was annual -- is that what you said, or did you say?

A. Right, those are annual productions for the project area from that Cherry Canyon formation.

Q. And 124,000 barrels of incremental, is that the difference in those two curves?

A. Yes, sir. Over a 10 year period. But we didn't run it indefinitely. But I feel safe to say that we would, over the long term, with this pressure maintenance program, that these wells definitely could extend the economic life and productive life considerably. Because we're still --

Q. You're still at a pretty high rate at the end of those 10 years according to the model --

A. Yeah, it looks pretty good.

Q. -- keeps moving along, though?

A. Exactly.

Q. With that amount of water production, how do you reconcile that with your testimony that there's no water drive?

A. Because of the high water saturations. We have about 45 percent water saturation. And much of it is movable. We don't think we have any water encroachment. A lot of that -- like we have a movable oil saturation, much of the 45 percent is movable water.

Q. Is there expansion of the water in the reservoir as your pressure depletes?

A. Probably not any expansion of the water. It's basically incompressible. You're oil

will expand. But we produce a lot -- it seems like the water, the mobility ratios-- seems like the water, the relative permeability of the water, is higher than that to oil.

Q. When do you plan to begin injection into the Brushy Canyon and the Bell?

A. We probably won't inject into the Bell Canyon. We will inject into the Brushy Canyon and Cherry Canyon at the same time, as soon as we're permitted to -- as soon as we have permission.

Q. So you plan to perforate the Brushy Canyon right away and begin injection into it, also?

A. We expect the Cherry Canyon to take a lot of the water because of the permeability. The Brushy Canyon, the permeability isn't that high, less than a half millidarcy. The Cherry Canyon is close to -- is around 20 millidarcys.

Q. So the 2,000 barrels of water a day, how much of that would go into the Brushy Canyon and how much into the Cherry Canyon?

A. There's no net footage of Brushy Canyon and Cherry Canyon -- it's -- We modeled based on 500 barrels a day in the Cherry Canyon. I would expect at least that or -- if I had to give you a number, I'd say 600 or 700 barrels a day into the

Cherry Canyon, 13 00 into the Brushy Canyon -- and that's just based on the permeability height considerations. The Cherry Canyon is so much more permeable than the Brushy Canyon.

Q. And now was your withdrawal balance to your injection rate, was that based on withdrawal from both the Brushy Canyon and the Cherry Canyon --

A. Yes, sir.

Q. -- or both of them? Are you requesting any increase in allowable for the Brushy Canyon?

A. Not at this time, no.

MR. KELLAHIN: We have one allowable for the whole pool and it's not separated out between the Cherry Canyon and Brushy Canyon. So the 107 barrels a day is the pool allowable that comes from the entire pool.

EXAMINER MORROW: But the 400-and-some barrel thing you requested there, what was the significance of that then? Why did you ask for 467 for those four?

MR. ~~KELLAHIN~~ Hargrove: That represents the maximum potential under the allowable scheme without increasing or asking for a special allowable.

EXAMINER MORROW: So you're not requesting that -- Did you ask that you be allowed

to produce that from any well within those four wells.

MR. ~~KELLAHIN:~~ Hargrove Yes. The flexibility to produce that volume in any combination of those four wells in the project area just gives us a little more flexibility.

EXAMINER MORROW: So you would be asking at least for that special consideration, if you --

MR. ~~KELLAHIN:~~ Hargrove Yes, sir.

EXAMINER MORROW: If one of them made 400 barrels and the rest of them made less -- made a small amount, you'd want to produce it that way?

MR. ~~KELLAHIN:~~ Hargrove Yes, sir, that's the difference.

EXAMINER MORROW: Does the overall injection interval requested -- does that include the Bell Canyon or --

MR. ~~KELLAHIN~~ Hargrove: No, sir.

EXAMINER MORROW: That's only the Cherry Canyon and the Brushy Canyon.

MR. ~~KELLAHIN~~ Hargrove: We haven't seen any -- we haven't determined that the Bell Canyon is productive in that area.

EXAMINER MORROW: But it is included as a part of this proposal, as I understand it,

initially?

MR. ~~KELLAHIN~~ Hargrove: Right.

EXAMINER MORROW: Do you expect to build an oil bank in this project? What will be your recovery mechanism, your secondary recovery mechanism here?

MR. ~~KELLAHIN~~ Hargrove: Do you mean do I consider this as a water flood or secondary recovery operation, or --

EXAMINER MORROW: Yeah.

MR. ~~KELLAHIN~~ Hargrove: I really consider it more a pressure maintenance. I consider it keeping this thing above the bubble point and keeping our solution gas drive. I don't -- that's what we based -- I mean that's what we modeled on, and at this point that's what we think is the thing to do.

If we went to -- if we expanded this thing to a full -- I think there will be some banking. And there's no doubt we're going to move oil hydrocarbon with this water, incidentally or otherwise. But if we went to -- if we expanded this pressure maintenance project to include the whole state lease or eventually made a unit out of this thing, you know, and went with the secondary operation, then, of course, we would have a water

flood. But I do think there will be some banking. I do think we will move oil with the water we do inject.

But since we haven't got -- we haven't reached bubble point yet, the initial benefits of this thing is going to be keeping the reservoir above that bubble point, not allowing the critical gas saturation to develop. And just prolonging the life of these things, keeping that from having -- keeping it in solution, maintaining our one and only drive out there, which is an oil solution gas drive.

EXAMINER MORROW: All right.

Mr. Hargrove, that's all the questions I have. I appreciate your testimony.

MR. KELLAHIN: We have nothing further.

EXAMINER MORROW: Case 10288 will be taken under advisement.

I do hereby certify that the foregoing is a complete record of the proceedings in the examiner hearing of Case No. 10288, heard by me on April 19 1991.

Examiner
Oil Conservation Division

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

REPORTER'S CERTIFICATE

I, GAIL D. VINSON, CCR, a Certified Court Reporter and Notary Public, DO HEREBY CERTIFY that I stenographically reported these proceedings before the Oil Conservation Division; that the foregoing is a true, complete and accurate transcript of the proceedings of said hearing so taken and transcribed under my personal supervision.

I FURTHER CERTIFY that I am not related to nor employed by any of the parties hereto, and have no interest in the outcome hereof.

DATED at Santa Fe this 20th day of May, 1991.

GAIL D. VINSON, CCR
Certified Court Reporter
CCR 297, Notary Public