BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
October 10, 1962

EXAMINER HEARING

IN THE MATTER OF:

Application of Western Development Company for a secondary recovery project, East Millman Queen-Grayburg Field, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks permission to institute a secondary recovery project in the East Millman Queen-Grayburg Field, with the injection of water into the Queen and Grayburg formations initially to be through 16 wells, located in Sections 11, 14, 15, 22 and 23, Township 19 South, Range 28 East, Eddy County, New Mexico, said project to be governed by the provisions of Rule 701. Case 2656

BEFORE: Daniel S. Nutter, Examiner.

TRANSCRIPT OF HEARING

MR. NUTTER: We will call Case 2656.

MR. DURRETT: Application of Western Development Company for a secondary recovery project, East Millman Queen-Grayburg Field, Eddy County, New Mexico.

(Whereupon, Western Development Company's Exhibits Nos. 1 through 8 were marked for identification.)

MR. LOSEE: A. J. Losee, Losee and Stewart, representing Western Development Company.

(Witness sworn.)

MR. LOSEE: With the Commission's permission, I would like to make a statement with respect to this case. This is an application by Western Development Company of Delaware as operator of what is now twenty-five producing wells in the East Millman Queen-Grayburg Pool, Eddy County, New Mexico to institute at this time a pressure maintenance project by the injection of water through approximately twelve wells.

It is our intention in connection with this application to show to the Commission that except for pressure maintenance that we request permission to institute at this time these wells would be in an advanced state of depletion on or about June 1 of 1963.

In connection with the application, and in the hopes that we will be permitted to conserve some of our reservoir energy and institute a pressure maintenance project at this time we request that we be granted an allowable for a pressure maintenance project up until the time our wells would have otherwise reached an advanced state of depletion, to wit, June 1 of '63, at which time and in this request the Commission would authorize a water flood project with a water flood allowable under Rule 701.

With that preliminary statement, our first witness has been

sworn, would you state your name, please?

MR. NUTTER: Just a moment, please, Mr. Losee, as I understand it, you would request authorization for a pressure maintenance project at this time, and that your testimony will purport to show that this project area would without the pressure maintenance project reach an advanced stage of depletion on or about June 1st of 1963, at which time you would request that the order would automatically cause this project to be reclassified from a pressure maintenance project to a water flood project, and the allowable provisions follow along with the reclassification?

MR. LOSEE: Yes, sir.

MR. NUTTER: Please proceed.

JACK V. BENDLER

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

DIRECT EXAMINATION

BY MR. LOSEE:

Q State your name, please.

A Jack V. Bendler.

Q Where do you live, Mr. Bendler?

A I live in Artesia, New Mexico.

Q What is your occupation?

A I work for the Western Development Company, Delaware, and with that company I have the position of Assistant Production Superintendent.

Q You have not previously testified before this Commission?

A No.

Q Where did you obtain your public education?

A Mason City High School, Mason City, Nebraska.

Q You graduated? A Yes, sir.

Q What higher education did you obtain?

A I graduated with a Bachelor of Science degree in petroleum engineering, University of Tulsa, Tulsa, Oklahoma.

Q In what year, Mr. Bendler?

A 1951.

Q Since that time what has been your occupation?

A Upon graduating from college I went to work with Phillips Petroleum Company. I spent four and a half years with Phillips and I was a reservoir engineer and a production engineer in the district office when I resigned to go to work for Honolulu Oil Corporation. I worked for Honolulu Oil Corporation for five and a half years, which I was district petroleum engineer. After working for Honolulu Oil I went to work at Western Development where I have worked for approximately

fourteen months now. My current position there is as Production Superintendent.

Q Since your graduation from college have you attended any schools in connection with your work?

A Yes, sir. I attended an industry reservoir school in Texas A. and M. in 1957 and had a four-week duration. It was sponsored by the Texas A. and M. Petroleum School.

Q Would you give us a brief history of this East Millman Queen-Grayburg Pool, please?

A Yes, sir. The discovery well was drilled and completed by Miller Brothers and it was called the Western Development State No. 1. This well was located in Section 14 of 19, 28, Eddy County, New Mexico. This particular well was completed April 11, 1958 for flowing potential of 250 barrels of oil in twenty-four hours. This discovery well was later acquired by Western Development Company of Delaware and Yates Petroleum Corporation, and it is currently known as the State 648 Well No. 181. The majority of the development in this pool was during the latter part of 1958 and 1959. As of June 1st, 1962 there were 60 producing wells listed on the New Mexico Oil Conservation Commission proration schedule.

The field produces from a series of zones in the Queen and the Grayburg sections and they range from 1750 feet to about

2300 feet. The Queen production occurs in sand zones whereas the Grayburg formation is principally from dolomites. In those wells in this project that are presently producing from the Queen and Grayburg zone are open to a common well bore and are commingled down hole. I believe that the Oil Conservation Commission considers this one common reservoir in that respect with regard to proration.

Q Please refer to what has been marked as Exhibit 1 and state what that is.

A Exhibit No. 1 is a plat which we indicate the proposed water flood project, also there is the location of the proposed injection wells and a location of all other wells and leases within a two-mile radius from this said proposed project, and also the formations from which these said wells are being produced.

Q Now, Mr. Bendler, does it portray a smaller project area than the area covered in your application, and if so, what acreage has been deleted?

A Yes, sir, we have deleted from our original application Wells No., and each one of these wells have a 40-acre proration allocation, and the wells are, starting in Section 11, 160 and 155 on State lease 648 in Section 14 on the same lease, State lease 648, wells at the north of the lease or the north of the section, 149, 148, 185, 161 and 178. Those have been deleted

from the project as well as in the original application.

Q That actually, then, the deletion of that area with the exception of the W. C. well, which well is in the southeast corner, isolates your project from any of the other wells in the East Millman Queen-Grayburg Pool?

A That is correct.

Q Please refer to what has been marked Exhibit 2 and state what that is.

A Western Development Company Exhibit No. 2, we included copies of radioactivity logs on all the proposed injection wells. Western Development Company proposes to inject water into the porous producing zones of the Queen and Grayburg formations through casing perforations, and which are so indicated on the logs. I think there is an exception in a well or two where we have an open hole completion.

The formation tops are marked, that is the formation tops for the Queen and the Grayburg and also the production casing points are so indicated on each one of these logs submitted.

Q Some of your wells are producing only from one, only from the Queen and not from the Grayburg?

A Yes, sir.

Q That information is shown on your Exhibit 1, is it not, as to which formation?

A No, sir. The Queen-Grayburg wells are the solid circle and some of those are Queen and some are Grayburg. They are not specifically designated which wells are Queen and which are Grayburg, but the injection wells listed on one of the coming exhibits will indicate those zones.

Q That information is also, of course, shown on these logs?

A Yes, sir.

Q Please refer to your Exhibit No. 3.

A Western Development Company Exhibit No. 3 is a graphic description of the proposed injection well casing program. This casing program, rather the exhibit portrays a typical well, injection well, and it is the State 648 Well No. 147, and as I said, this particular well we consider is a typical example of our injection wells.

With reference to this particular exhibit, the Queen formation topped there is 1681 and the Grayburg is 2026. We, as Western Development Company, propose to equip each dual injection well with tubing and a packer. This will facilitate simultaneous water injection into both the Queen and Grayburg reservoirs. As an example, it will be down tubing below the packer into the Grayburg and down the casing tubing annulus above the packer into the Queen. However, those injection wells where injection

will be into only one producing formation. It is proposed that the water be injected down casing. We propose to inject water into each of these injection wells at an approximate pressure of 1200 psi and at a rate of 300 barrels per day.

Q What is your proposed water source for this project?

A Our proposed water supply for this project, we will hope to develop by drilling shallow fresh water wells within this project area, and they are so marked on the Exhibit No. 1 where we will probably locate these particular shallow wells. We have considerable amount of cable tool information in this area and they indicate the occurrence of a substantial supply of fresh water along the south and southeast portion of the project area. However, in the event that this source is inadequate, why we propose to obtain additional injection water from one of the several water companies.

Q Mr. Bendler, are you not operating, is Western Development Company not operating a water flood project in Section 10 immediately to the north of this proposed project?

A Yes, sir, we sure are.

Q What is your source of water for that Section 10 project?

A It is a fresh water well, shallow fresh water well drilled in the northern part of Section 14, and it's just west, I believe, of Well No. 149 in State Lease 648.

Q Up to this point has that well been adequate for your water supply for that other project?

A Yes, sir, it has.

Q Please refer to your Exhibit No. 4, state what that is.

A Western Development Company's Exhibit No. 4 is a tabulation of statistical data for each proposed injection well. Now, this exhibit lists in part the casing size, the depth set, the volume of cement used in the two strings of casing which is run in each well. I would like to call your attention that each string of casing has been cemented with an adequate amount of cement to isolate and protect both the fresh water sand behind the spacing string and the oil-bearing zones behind the production string. There's one exception to this and that is State Lease 648 Well No. 151 which does not have a cemented surface string. However, in this particular case we propose to inject water into the Queen formation only inasmuch as this will not be a dual injection well. It does produce only from the Queen formation. We propose to inject down tubing below a packer in this particular injection well.

Q Does this exhibit, with your calculation are you able to state how many feet above your shallowest perforation is your cement carried?

A Yes, sir, I can. In all but two of these injection

wells we propose calculated top of cement would be at least 200 feet above top perforations. The two exceptions will be State E-5003 Well No. 1 and Malco State Well No. 3, and both of these wells calculated cement top will be in excess of 100 feet above the perforations. That is in the production string.

Q Please refer to what has been marked Exhibit No. 5 and state what that portrays.

A Western Development Company Exhibit No. 5 is a graph of the oil production rate in barrels per month versus cumulative oil production in barrels. Curve No. 1 on this exhibit is a plot of the actual production rate through September, 1962. The dashed line portion, which is Curve No. 2, is a projection of the current established production decline.

Q Does this graph also include the seven wells that have been deleted from our application as to the project area?

A Yes, sir, they do. These seven wells, as you remember, were in the State Lease 648, and in view of any accurate way of determining the production for these seven wells, it was not attempted to delete it from the curve.

Q Is there any distinction as to the production history on those seven wells from the production history on the other wells in your project area?

A Well, there is some distinction, yes, sir, possibly

being on that side of the project they would be much better than the wells, the productivity would be much better than those say on the southeast side or the east side.

Q Are they somewhat similar, the production history of both of them?

A Yes. The production history of those wells will be similar to those wells in the project, yes, sir.

Q So that actually the only thing that would occur to this graph from your knowledge, if you were to take it, if it were possible to take out those seven wells is it would reduce the amount of production history, it would not change the curve?

A No, sir. It's my opinion that the slope of the curve would be the same.

Q Please refer to what has been marked Exhibit 6. State what that is.

A Western Development Company Exhibit No. 6 is a plot of production rate in barrels per month versus time. Now, Curve No. 1 represents the actual production rates through September, 1962; dashed line portion of the Curve No. 2 is a projection of future rates based on an integration of Curve No. 2 and Exhibit No. 5 with respect to time. In other words, that particular curve on this Exhibit No. 6 is directly related to the curve in Exhibit No. 5.

Q Are your same statements with respect to the seven wells that you have deleted from the project area, your statements with respect to Exhibit 5 the same with respect to Exhibit 6?

A Yes, sir.

Q In your opinion, then, if those wells were included from this curve, would there be any material change in the curve?

A No, sir.

Q At what date on this curve, in your opinion, would you state these wells would be in an advanced state of depletion?

A June 1st, 1963.

Q What is the approximate present average production of the wells in your project area?

A Currently our average production will be around 15 barrels per day per well.

Q Now, in your recent form that you reported to the Commission from that information, can you state whether or not any wells are materially over 15.5, 15½ barrels?

A Yes, sir, the form to which you refer is the Oil Commission Form C-116, gas-oil ratio form which was sent to the Oil Commission about October 10th, and the highest production on a per well basis on any one of the wells was around 17 barrels per day.

Q It's due in the Commission today, then, actually?

A Yes, sir, but we took the tests in September.

Q From your tests there were no wells making over 17 barrels?

A No, sir. That was the maximum recorded.

Q What has Western Development Company done to maintain the production of its wells in this project area?

A As soon as the wells in the beginning failed to make their top allowable we endeavored to put them on the pump as soon as possible. I believe that currently there are only three wells within the project area that are not on the pump.

I would like to refer to the Exhibit No. 1. State Lease E-503, that particular well, and also State Lease 648 163, we do not consider that it would be economically feasible to put a unit on it at this time due to the low productivity of the wells. The only other well that I could truthfully say is not on the pump is the 144 in Section 14 of 648, State Lease 648. We are currently putting it on the pump. Just as soon as we can get out pulling unit available to put it on. We have had it on our list of jobs to do in the last few weeks.

Q It's probably on the pump then, actually now, is that right?

A Well, sir, I couldn't say today that it's actually on,

but it certainly is reasonably possible.

Q From the characteristics of the other wells in the project area that you placed on pump, what will happen to this Well 144 that you are just putting on the pump now?

A We anticipate that this well probably will make top allowable, top unit allowable.

Q For how long?

A For probably thirty-day period, the maximum, and then start declining. That has been the history of the other wells. Incidentally, we have endeavored to pump these wells and we do have them on the pump. We try to maintain as much casinghead pressure as we can and still efficiently pump these wells in the method of conservation of our reservoir pressure.

Q Now, looking back at your Exhibit No. 6, and referring to the sharp lines that occurred, the upsweeps in production from December of 1960 down to the last one in about March of this year, can you state what has made those sharp breaks in the increase in the production?

A Yes, specifically the one that occurred in March of 1962. That particular peak in the curve is due to placing several wells on the pump. As you can see, the production after a little bit of flush period there, which I tried to describe what happened in the Well 144, the same thing occurred here, your

decline rate assumed it's same slope thereafter.

Q Actually, with the exception of these three wells you mentioned that are not on pump, or are just now being placed on pump, when was the last well placed on pump in this project area?

A Well, I believe probably, oh, let's see, the last one, inside the project area it was probably in about April, I would say, maybe May. I can't say for sure.

Q Is there anything else, in your opinion, that your company might do or might have done to maintain the primary production from these wells?

A No, sir. Mechanically, I do not believe that there is anything else we could have done. We do believe that early installation of pressure maintenance would be the only answer to production rate and also recovery.

Q Have you had an opportunity to compare the production, a similar curving in this pool to other Queen-Grayburg Pools in southeastern New Mexico?

A Well, to further qualify that, I would rather say that the reservoir characteristics of the East Millman Queen formations are similar to the Caprock Queen and the Grayburg is similar to the Artesia Field, of which there are floods currently in progress as well as the Caprock Queen. I believe they are similar, yes, sir.

Q Well, the question really is, is the production decline curve that you portrayed on Exhibit 6 similar to the production decline curves in these other fields of Queen and Grayburg formations? Are they similar?

A Yes, sir, I'm sure you can say they are similar, yes, sir.

Q Why do you request the permission for authority at this time to institute a pressure maintenance project rather than waiting until next year when the wells are in an advanced state of depletion?

A Well, in our opinion, and it is also our intent to inject water into the above mentioned producing formations in sufficient quantities and with a sufficient pressure to arrest bottom hole pressure decline, and effectively control the gas-oil ratios, and also stimulate production from each of the producing wells within the project area.

Q In your opinion would it be in the interest of conservation to commence the injection of water at this time?

A Yes, sir, it would. The current rate of decline that is exhibited or shown by Exhibits No. 5 and 6, I do believe that early initiation of pressure maintenance will increase our ultimate recovery, and the earliest date possible would be the best, yes, sir.

Q From your history up here in this Section 10 flood that you earlier referred to, in your opinion will this Queen and Grayburg formations, are they floodable?

A Yes, sir, I would rather refer to the Grayburg formation, however, in Section 10. We are currently injecting water in those wells at about 350 to 400 barrels a day at about 650 to 700 pounds pressure.

Q Please refer to what has been marked as Exhibit 7 and state what that is.

A Western Development Exhibit No. 7 is a monthly GOR versus cummulative oil production curve. If you will note the limitations on the curve there, September, 1960 was when Phillips started gathering gas, casinghead gas in the field, and we have an accurate record of gas takes in the area as of that date. Therefore, anything prior to that I wouldn't consider would be accurate information, so from that date on to the current date of September, 1962, it can be seen by this exhibit that gas-oil ratios are on the incline currently, inasmuch as we consider this reservoir to be a solution gas drive reservoir, this is in keeping with certain stages of depletion.

Q Would it be an aid to control this gas-oil ratio by injection of water at this time?

A Yes, sir. We would hope to arrest the pressure, bottom

hole pressure decline, also with the flexibility of closing certain high ratio wells in as part of the proposed rules of a pressure maintenance project that we could effectively control the high gas-oil ratios, which would certainly be in the interest of conservation.

Q Have you made a calculation or estimate as to the amount of oil that you might recover from this combination pressure maintenance and water flood project, or the amount of oil compared to your primary recovery?

A Yes, sir. A conservative estimate on primary recovery with the combined reservoirs we anticipate probably around 15½% primary. Due to any reservoir information which would certainly aid in a further accurate determination of secondary recovery by benefit of other floods that we've studied, I think that somewhere between one and two times primary would be probably what we will least expect on secondary recovery.

Q How much primary oil have you recovered, or do you anticipate will be recovered from this reservoir if you don't have the present figure?

A Well, our current cummulative production I believe is right at 900, around 900, almost a million barrels, and we anticipate ultimate recovery of probably around 1,580,000 barrels of primary oil.

MR. NUTTER: 580,000?

A Yes, sir, 1,580,000.

Q Then it's your testimony that by this secondary recovery program of pressure maintenance now and water flood next year, you will recover one and two times that amount of oil?

A Yes, sir, one to two times.

Q One to two times? A Yes.

Q I hand you what has been marked Exhibit 8 and ask you to state what that is.

A Western Development Company's Exhibit 8 are the recommended rules and regulations for the East Millman Queen-Grayburg Oil Pool pressure maintenance project.

Q These rules then, you propose to remain in effect until June 1 of next year, at which time it would be a water flood project?

A Yes, sir.

Q Have you compared other pressure maintenance project field rules issued by the Commission or entered by the Commission in the last few years, and if so, how do they compare with these proposed field rules?

A Yes, sir. I have studied numerous recent projects and these rules I feel are certainly comparable. Some may be, perhaps the only difference that I can state with regard to some

of the recent ones, we do propose perhaps that the word response be deleted from direct or diagonally offset wells to wells outside the project that are producing from the same producing interval inasmuch as we consider our wells inside, I mean the project line as inside our own property or our own lease line, why we consider possibly it wouldn't be necessary to have the word response included in the rules.

Q That is under what you have proposed as Rule 7 and Rule 10?

A Yes, sir.

Q And the reason you feel like your project area is different than others, if I understand your statement, is that your project area is all within your lease lines and there are no direct offsets to your project area except the Welch wells to the southeast?

A Yes, sir, I'm sure that we can state that we're in the same stage of depletion that our wells are in that area.

Q The Welch wells in the southeast?

A Yes, sir.

Q Do you have anything further that you would like to offer in this case, Mr. Bendler?

A No, sir.

MR. LOSEE: The applicant will move for the introduction

of Exhibits 1 through 8.

MR. NUTTER: Applicant's Exhibits 1 through 8 will be admitted in evidence.

(Whereupon, Western Development Company's Exhibits Nos. 1 through 8 were admitted in evidence.)

MR. LOSEE: That's the applicant's case.

MR. NUTTER: Prior to calling for cross examination of the witness we will take a two-inning recess.

(Whereupon, a recess was taken.)

MR. NUTTER: The hearing will come to order, please. Are there any questions of Mr. Bendler?

CROSS EXAMINATION

BY MR. NUTTER:

Q I realize, Mr. Bendler, that a man can probably tell which are the Queen wells and which are the Grayburg wells from examination of the casing, cementing and perforation exhibit here.

A Yes, sir.

Q I don't know what number that is.

MR. LOSEE: Five.

MR. NUTTER: One of the curves is five, I believe.

A No. 4.

Q I wonder if you would read into the record the ones that are completed in both zones and the ones that are completed

in just a single zone and which zone that would be?

A Yes, sir. Just one moment please. May I ask a question, you mean of the injection wells or all of the wells in the project.

Q All of the wells.

A Okay. If it would be all right with you I would like to go over them numerically in State Lease 648.

Q All right.

A Now, 143 is Queen only, 144 is a dual Queen and Grayburg, 145 is Queen and Grayburg, 146 is Queen only, 147 is Queen and Grayburg, we'll skip 148, that's outside and 149 is outside, 150 is in both zones, Queen and Grayburg, 151 we had casing set deeper but we were only producing casing perforations in the Queen formation. 152 is in the Queen-Grayburg.

MR. IRBY: Which well is 152?

A That's in Section 22 in the Northeast of the Northeast.

MR. IRBY: Thank you.

A 153 is both zones, Queen and Grayburg, 154 is in both zones, 155, that's not in the project, though, 156 is Queen only, wait a minute, I'm sorry to take your time this way, but I have to skip back and forth. Some of the casings, if you will bear with me, are set in both zones.

Q But not perforated in both?

A Yes. Sorry I didn't have that information. I want to check 156. 156 is both zones, 157 is both zones, 159 is both zones, 160 is outside the project, 161 is outside the project, 162 is in both zones, 163 is in the Queen only, 165 is in the Queen only, 178 is outside the project, 181 is Queen only, that's Queen and Grayburg, 181, 182 is a Queen only, 183 is a Queen only, I'm sorry, that's a Queen-Grayburg, there were three workovers and a last one we completed in the Queen-Grayburg, 184 is Queen only, 185 is outside the project.

Now, go to the Malco State, Malco State No. 1 is Queen only, No. 2 is Grayburg only, and State Lease E-5003 Well No. 1 is Queen and Grayburg both. I believe that is it in the entirety.

Q Well, now, Mr. Bendler, an examination of the plat without reference to the formations that they're completed in would indicate that you had a perfect five spot 80-acre water flood pattern here. But then with reference to the formations that the wells are completed in, this perfect five spot pattern disappears, is that not true, when you compare Queen and Grayburg or just Queen?

A I'm sure that's quite possible.

Q Is it the intention of Western, Yates to recomplete the wells in the Queen only? The injection wells in the Queen only and open up additional perforations in the Grayburg on any of them?

A Well, if we were to do that there is certain portions of the reservoir there, the Grayburg isn't present, and there may be some workovers with regard to what we may not want commercially as an oil well, but it may be good to inject into the producing formation as an injection.

Q That's what I had reference to, take 181 Queen-Grayburg, 184 directly north of it is a Queen, 143 directly west is a Queen well and the 182 directly south is a Queen well, so you wouldn't be able to flood the Grayburg in the No. 181 at all then?

A Well, wherever it doesn't fit, we may have to adjust our, let's see, the 181 is the one you are referring to?

Q Yes, sir, you said it was Queen-Grayburg, yet none of the offsetting wells have a Grayburg opening.

A Well, the 143, we do not consider it has a Grayburg section, and the 144 and the 151 and the 165. Now, you take 184 and 146, they're right on the line in the Grayburg with regard, when I say right on the line I mean that it's quite possible we might want to, let's see, 184 was an injection well.

Q I was just referring to the wells on the injection pattern and the formations that they were completed in.

A Yes, sir. That particular well through, after we obtain a little injection and pressure data it may be necessary

to maybe open the Grayburg, say, in the 184, and inject water in it. That's as an example, and 146, of course, is not an injection well. All the other wells we'd consider having a Grayburg section we'd probably attempt to evaluate secondary prospects.

Q Then the opposite is true down here on the Western Yates Malco lease where the No. 1 well is a Queen well but two of the offsetting wells, the No. 2 and the 3 are Grayburg only?

A Yes, sir.

Q So there wouldn't be any water injection into the Queen formation through those two wells? There is the possibility that as time goes on you may want to open an additional section in some of the wells, is that correct?

A Yes, that is a possibility, yes, sir.

Q Did I understand you, Mr. Bendler, to say that the calculated cement tops on all of the wells are at least 200 feet above the perforations with two exceptions?

A Yes, sir.

Q That was the 503 No. 1 and what was the other well?

A Malco State No. 3, I would say that they are in excess of 100 feet, though.

Q You think it's in excess of 100 feet in those two wells?

A Yes, sir.

Q The one well that does not have the surface pipe cemented in will be used as a single zone injection well with the injection down tubing and under a packer?

A Yes, sir.

Q Another thing you said you were going to inject 300 barrels per day at what expected pressure?

A Probably overall, looking at both zones, it could be 1200 pounds. That's based on analogies of their related reservoirs that are under flood right now.

Q Do you anticipate this is a solution gas drive in both of these pays?

A I would consider 100% on the Queen that it is a solution gas drive. There is insufficient data with regard to the Grayburg to say that it does not have an active water drive. I don't believe that we do. The Grayburg and Queen reflect structurally and the Grayburg dips to the southeast, and that is one of the barriers limit on the production limit is water occurrence downdip on the Grayburg.

Q To the southeast?

A Yes, sir. If there is a water drive, how much it contributes to the reservoir mechanism we couldn't say. My personal opinion, and I believe I will say it for our company,

is that it is not significant.

Q So you do feel that the majority of the reservoir drive would come from solution gas in the Grayburg also?

A Yes, sir.

Q The 15½% primary recovery that you estimated would be for the two zones?

A It's combination, yes, sir.

Q Would it be approximately the same for each of the two zones?

A No, sir. If you would bear with me here, I'd say that the Queen would probably be maybe 17 or 18% and the Grayburg would be, I don't want to give you any misinformation here with regard to my opinion, approximately 14% in the Grayburg.

Q You mentioned that the new tests had been turned in on the wells. Did that include all of the wells in the project area?

A Yes, sir.

Q Would you happen to have a tabulation of the amount of oil that the wells made on the most recent test?

A On a by well basis, per well basis?

Q Yes.

A Not with me, no, sir.

Q Do you have a tabulation of the production by well for

the last month that that figure is available?

A For instance like on the C-115?

Q Yes, sir, for September, or whatever the last one was.

A No, sir, I don't have that with me either.

Q I wonder if you could, when you get home, send us a tabulation of the per well production for the month of September?

A Yes, sir.

Q That would be the most recent complete month?

A Yes, up to date.

Q And your production decline curve Exhibit No. 6, takes the production down through September, but that's for the entire 32-well area, including the acreage which was deleted, is that right?

A Yes, sir.

Q That figure is approximately what for the month of September there?

A Let's see, that would be about 14,250, just roughly.

Q That's the total production for the 32 wells for the entire month of September, then?

A Yes, sir. I believe on a daily basis that figure is about 458 or 490, something like that per day.

Q Referring to your Exhibit 7 which represents the monthly GOR versus cummulative oil production since the wells

had a casinghead gas connection, this curve appears to be a series of high peaks and low dips. Would you explain that, please?

A I will attempt to. In June, if you notice on the Exhibit No. 6, Curve No. 1, we have a high about March, or a peak on the rate curve, that's when we put some pumps on, and I believe that the GOR at the same time, or shortly after that time, had another peak right in there. The basis of that, probably after a flush period you see, why the oil rate dropped and the gas volume stayed about the same, which would make a little higher ratio and then it kind of started leveling off again on the decline.

Q This is a composite GOR for all of the wells in the area?

A Yes, sir, of all 32 wells, yes.

Q Is there any significant difference between the gas-oil ratio on the Queen and on the Grayburg?

A Well, those wells that, I can't make a positive statement there. I believe in my opinion there's some examples of both cases probably. For instance, you take that 163 well which is Section 15, it has a high, fairly high ratio, but it has a real low oil volume, it's an edge well, of course; and then, of course, another example would be the E-5003 up there. It produces from both zones and it has a high ratio and low oil

volume also.

Q There are two wells that are Grayburg only, the Malco 2 and 3. How did the ratios run on those wells?

A I can tell you the lease ratio is running around, oh, twenty-one and twenty-two hundred.

Q That would be one Queen well and two Grayburg wells?

A Yes, sir. We do have some water production down there too. You see, the Queen is on the edge of the reservoir there. The one well may contribute a little more gas than the two Grayburgs. I don't think it's appreciably different in that particular case there as regard to edge wells and infield wells too.

Q Now, the new C-116's that you have just filed, do they show the amount of gas produced from each well as well as the oil production?

A Yes, sir.

Q Are those twenty-four hour tests, do you know?

A In the majority of the cases they probably are, yes, sir.

MR. NUTTER: I believe that's all, Mr. Bendler. Does anyone else have a question of Mr. Bendler?

MR. DURRETT: Yes, sir, I have one question.

MR. NUTTER: Mr. Durrett.

BY MR. DURRETT:

Q There seems to be some confusion as to the actual number of wells that are to be injection wells, the case was advertised as sixteen wells to be injection wells?

A Yes, sir.

Q I count specifically thirteen on your Exhibit 1, and I think I heard you mention twelve on direct. Would you clarify that?

A I believe in the statement that Mr. Losee made he said twelve wells or approximately twelve. He should have said thirteen.

Q But it will be thirteen injection wells, is that correct?

A Yes, sir, I believe that's correct.

BY MR. NUTTER:

Q One other question, Mr. Bendler, you were mentioning that as far as Rule 7 which you were proposing in your project rules, that you would delete something that had reference to response. Has that been deleted from the Rule No. 7 as you have proposed it here? Has that been deleted from the previous Rule 7's that the Commission has entered, and is this Rule 7 the one that you propose?

A I believe that Rule 7 is the one that that response

was deleted from. I think Rule 10 in other projects did not have that statement. I believe that's correct.

Q In other words, these are the rules that you propose? You don't propose a further amendment to these which you have presented here in Exhibit 8?

A No, sir. As far as the pressure maintenance is concerned for that duration, these are the proposed rules.

MR. NUTTER: Any further questions of Mr. Bendler? Mr. Irby.

MR. IRBY: Frank Irby, State Engineer's office.

BY MR. IRBY:

Q Mr. Bendler, for the record would you state the depth of your shallow water well, that is your source of supply for this flood and the formation in which it's bottomed?

A If I understand your question correctly, you asked for this particular project, I think perhaps you mean for the water well for this Section 10 project, is that what you mean? We do not have a current water well drilled for this project.

Q I'm referring to the water well in Section 14 which you stated is now being used.

A Yes, sir, that well is the source of water for the flood in Section 10, Northeast there. The depth of that water well is about 235 feet to total depth.

Q What formation is it bottomed in?

A Well, I believe it's a Rustler. I could verify that, I believe, by counsel with my geologist.

Q I'm interested in where it's bottomed and whether or not it penetrates the entire aquifer.

A In my opinion, I believe that it penetrates the entire aquifer present at that point.

Q That's an opinion rather than a fact?

A Well, yes, I would say that's a fact. I'm sorry I misstated it, it would be a fact.

Q Then completely penetrates the Rustler formation. What formation is it bottomed in?

A When you say aquifer, maybe you included all the Rustler anhydrite as the aquifer. What I meant, we have penetrated the water zones in the Rustler anhydrite, if there is anhydrite below it, it is water free. There still is an anhydrite section before you get to salt.

Q You mean that the well is, I am not sure I understand you, that's the reason I keep after you. You mean that the well is bottomed in a impervious strata of anhydrite, is that correct?

A Yes, sir.

MR. IRBY: I don't want to build up a lot of record here, but I would like to state for the Examiner's benefit why I'm going

into these questions and that is that in a recent hearing that consumed nine long days, entirely expert testimony from eight expert witnesses indicates water zones of useable water below this known aquifer, which we have just discussed in Rustler. I'm apprehensive as to what may happen in these wells with regard to that section between the bottom of the surface casing which is indicated on his Exhibit 4 as 336 feet and the top of the cement in the annulus behind the production string which is indicated on the same exhibit as being at 1073 below the surface. I don't want to put a heavy burden on the applicant in this case, and I don't want to be argumentative about this, but I want to be assured that the construction program of these wells is adequate to prevent the escape of any injected water into any zone of porosity or permeability which may exist between these two depths indicated on Exhibit 3.

I don't know whether this can be done or not. If the Examiner can write an order which would permit this subject to proof of adequate casing program and allow a brief but reasonable time for me to go into this with the technical staff of my office and the Western Development Corporation, I think that this can be worked out. I'm not sure whether you can enter such an order, but with no more assurance than I have today I would find it necessary to object to the construction program on these

injection wells. It may be that this can be worked out without any additional cost whatever if we can come to a meeting of the minds as to the geology between these two points or as to some other method of determining from time to time whether there is a means of determining whether or not leakage has occurred.

MR. NUTTER: Mr. Irby, do the sand stringers, or whatever they are, these porous and permeable zones that contain additional water supplies which were indicated by this nine-day hearing, do those zones appear on the logs of wells which are drilling and logged?

MR. IRBY: Yes, sir, I'm not sure that they do in this field, but they do at adjacent periods.

MR. NUTTER: At the points where they have been found they show on the logs?

MR. IRBY: Yes, sir.

BY MR. NUTTER:

Q Do you have available logs for all of the twelve injection wells, or thirteen, whatever it is here in this Exhibit No. 2? Are they all here?

A Yes, sir, they are all there, but they do not necessarily go to the surface.

Q These are just lower section logs?

A Say 150 feet above the Queen, but these logs that we

have presented as testimony are a part in almost all cases of logs to the surface.

Q And you do have the logs to the surface on all of these wells?

A I think that we do, but if we do not, I'm sure, in other words, if all the logs don't go to the surface, which I'm sure they do, but if they do not I am sure that fresh water zone is collatable to where it would be positive.

Q Were temperature surveys run on any of the wells to determine where the top of the cement was?

A To my knowledge, no, sir.

Q So these are all calculated tops?

A Yes, sir, based on the description on Exhibit No. 3.

Q Is there any technique that is available today which can be run in the wells that would determine top of the cement? Would a bond log show that?

A Yes, sir. I believe in the majority of the cases that it does.

Q Then a bond log can be run on a ~~log~~ well long after the cement has dried?

A Yes, sir. Of course, I think in industry there's some difference of opinion as to the validity of the bond logs, but probably in the majority of the cases you probably could pick

out a top. At least the logging companies, I'm sure, will say that you could.

MR. NUTTER: Off the record.

(Whereupon, a discussion was held off the record.)

MR. NUTTER: We'll go back on the record and you can make a motion to continue the case until the tail of the docket if you want to.

MR. LOSEE: I'll move that this case be continued to what I hope is not the end of the docket, but at least later on in the day.

MR. NUTTER: Case No. 2656 will be continued till later on in the day.

***

MR. NUTTER: We will reopen 2656. Mr. Losee.

MR. LOSEE: Mr. Examiner, I have a stipulation which I understand has been agreed to by my client Western Development Company and Mr. Irby with the State Engineer's Office which will result in a withdrawal of his protest. The stipulation is that my client agrees to take the thirteen injection wells, proposed injection wells in this project and fill the spacing annulus with water shortly after this hearing, sometime within the next few days, and fill it to the surface, leave the water in there for one week, at which time they will observe the drawdown or

absorption by adding water back into the annulus, and in the absence of any material drop in the water, or leakage showing up by reason of this test, the casing program through the injection wells will be satisfactory to the State Engineer.

In addition we will agree and it can be made a part of the order that we will furnish each month to the State Engineer's Office with a copy of the Conservation Commission form which reflects the pressure on each of the injection wells. Is that substantially correct, Mr. Irby?

MR. IRBY: That is correct, and I so stipulate for the State Engineer and as a result thereof withdraw the objection earlier entered in this matter.

MR. NUTTER: Is the purpose of filling this annular space to determine if there is any porosity or permeability down there that would take the water and possibly also could be producing water?

MR. LOSEE: Yes.

MR. NUTTER: To determine the presence of porous zones in the uncemented interval?

MR. IRBY: Yes, sir.

MR. NUTTER: Mr. Losee, I would like to recall Mr. Bendler since this case is reopened and ask him one more question, if you like.

MR. LOSEE: All right.

CROSS EXAMINATION
(Continued)

BY MR. NUTTER:

Q Mr. Bendler, examination of the plat which you furnished us as Exhibit No. 1 in this case would indicate that there are probably three leases involved in this project, is that correct?

A Yes, sir.

Q It would be the 5003, the 648 and the Malco State lease?

A Yes, sir.

Q Can you tell me if the beneficiaries of these three state leases are identical in each case?

A Yes, sir.

Q They are? That's all I wanted to know.

MR. NUTTER: You are excused.

(Witness excused.)

MR. NUTTER: Does anyone have anything further they wish to offer in Case 2656?

MR. DURRETT: Yes, sir.

MR. NUTTER: Mr. Durrett.

MR. DURRETT: The Commission has a letter in the file ~~of~~ Gulf Oil Corporation, and with your permission I would like

to read a rather lengthy paragraph from this letter, reading as follows. This letter was received October the 5th, the letter reads as follows, the pertinent paragraph:

"The application as advertised provides for water to be injected initially through the 16 injection wells in Sections 11, 14, 15, 22 and 23, Township 19 South, Range 28 East. We have been informed verbally by Western Development Company that they propose to initially inject only into Wells No. 143, 145 and 147 in Section 14 and Well No. 151 in Section 15. It is assumed that the project area will comprise these wells and the direct and diagonal offset well. If this is the case Gulf has no objections provided that the provisions of Rule 701 are complied with insofar as notification to offset operators for expansion of the project area is concerned. If approval is requested by Western for all 16 injection wells without further need for expansion approval, then we object to placing the wells on injection at this time that offset or top allowable Eddy State BN and AN Leases located in Sections 11 and 13. Respectfully", signed W. B. Hopkins for Gulf Oil Corporation.

MR. LOSEE: I would like to make a statement with respect to the letter.

MR. NUTTER: Yes, sir, Mr. Losee.

MR. LOSEE: After our client received a copy of this

letter from Gulf Corporation I discussed the matter with Mr. Kastler, their attorney in Roswell, explained to him that it was our intention, by reason of this application, to request authority at this hearing to place all of the wells on injection, that in view of his letter we would agree and did back our line up so that we do not directly, our project area does not directly offset Gulf's leases.

We discussed the necessity of a further letter from Gulf Oil Corporation and they felt like that none further was needed in view of the way they'd worded the last sentence of this. We object to placing the wells on injection at this time that offset our top allowable and, actually, by our drawing the line back in the project area one location we do not directly offset Gulf in any case.

Now, there is a diagonal offset injection well. I do not have the map in front of me, which we intend to, and request authority to place it on injection at this time. It's included within our project area.

MR. NUTTER: You are certainly not asking for just the four wells that they mentioned in this letter, however?

MR. LOSEE: No, sir, I wanted to make that clear, and by the same token we tried to save their protest by drawing our project area line back one location.

MR. NUTTER: Does anyone have anything they wish to offer in Case 2656? We'll take the case under advisement.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 5th day of November, 1962.

Ada Dearnley
Notary Public-Court Reporter

My commission expires:

June 19, 1963.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2656, heard by me on 10/10, 1962.

....., Examiner
New Mexico Oil Conservation Commission