

Case Number

4367

Application
Transcripts.

Small Exhibits

ETC.

Mobil Oil Corporation

P.O. BOX 633
MIDLAND, TEXAS 79701

June 16, 1970

Mr. Dan Nutter
Oil Conservation Commission of New Mexico
P. O. Box 2088
Santa Fe, New Mexico 87501

Re: June 10, 1970 Hearing -
Application of Mobil to
Expand Water Flooding
Operations on the Bridges
State Lease, Vacuum GBSA Pool
Lea County, New Mexico

Dear Mr. Nutter:

Pursuant to your request at the conclusion of the June 10 hearing, I am forwarding the attached tabulation of test and well status information on all of Mobil's wells which have been completed in the Grayburg - San Andres formation in Sections 25, 26 and 27, T-17S, R34E, Lea County, New Mexico.

I might observe that the most recent oil test on Bridges State No. 26 was taken March 26, 1970 when measured production was 1 BO + 20 BW per day.

Yours very truly,

Patrick W. Kelly
Patrick W. Kelly

PWKelly/lh
Attachment

cc: Mr. Victor Lyon
c/o Conoco
P. O. Box 460
Hobbs, New Mexico 88240

Mr. Paul Zeman
c/o Marathon Oil Company
P. O. Box 552
Midland, Texas

Mr. Jim Sperling
P. O. Box 2168
Albuquerque, New Mexico 87103

MOBIL OIL CORPORATION
TABULATION OF WELL TEST
AND WELL STATUS DATA SECTIONS 25, 26 & 27
OF BRIDGES STATE LEASE T-17S, R34E
VACUUM GBSA POOL, LEA COUNTY, N. M.

LEASE AND LOCATION	UNIT	WELL NO.	DATE OF TEST	OIL BBLs./D	WATER BBLs./D	REMARKS
Bridges State, Sec. 25, 17S, 34E	A	17				Converted to S.I. WIW 1-1-70
	B	16	4-1-70	1	0	
	C	32				Recompleted to Blinebry 2-63
	D	36				T.A. 3-1-67
	E	13				Recompleted to Blinebry 2-63
	F	11				Recompleted to Blinebry 2-63
	G	14	3-16-70	4	1	
Bridges State, Sec. 26, 17S, 34E	A	38				Recompleted to Blinebry 3-63
	B	4				T.A. 12-31-62
	C	5				Converted to WIW 10-31-67
	D	28	4-1-70	1	3	
	G	30				Recompleted to Blinebry
	H	27				Plugged San Andres Zone 3-63
	I	25	6-2-70	11	2	
	J	33	4-1-70	5	1	
	K	35	3-20-70	5	0	Converted to WIW 4-24-70
	L	39	4-1-70	3	1	
	M	29	3-16-70	7	2	Converted to WIW 4-24-70
	N	26	5-15-70	0	60	
	O	15	6-2-70	30	0	
	P	12	6-4-70	25	0	
Bridges State, Sec. 27, 17S, 34E	A	52				Converted to WIW 1-1-70
	H	49	4-1-70	1	0	
	I	48				Shut In - T. A.
	O	42				Converted to Shut In WIW 1-1-70
	P	44	4-1-70	1	1	

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BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
June 10, 1970

EXAMINER HEARING

IN THE MATTER OF:

Application of Mobil Oil
Corporation for a waterflood
expansion, Lea County,
New Mexico

Case No. 4367

Application of Mobil Oil
Corporation for a waterflood
expansion and amendment of rules
governing same, Lea County,
New Mexico

Case No. 4368

BEFORE: Daniel S. Nutter
Examiner

TRANSCRIPT OF HEARING

MR. NUTTER: Case No. 4367.

MR. HATCH: Application of Mobil Oil Corporation for a waterflood expansion, Lea County, New Mexico.

MR. SPERLING: I am James E. Sperling with Modrall, Seymour, Sperling, Roehl and Harris, appearing for the applicant in this case. Mr. Examiner, at this time, we would like to request that this case 4367, and the following case 4368 be combined for the purpose of receiving testimony.

MR. NUTTER: 4368.

MR. HATCH: 4368; Application of Mobil Oil Corporation for a waterflood expansion and amendment of rules governing same, Lea County, New Mexico.

MR. NUTTER: 4367 and 4368 will be consolidated for purposes of testimony.

In an effort to streamline the hearing of this matter, we, on our own volition, took one of the wells out of the applicant's application for 4367, and advertised it as a part of 4368. Applicant, in his application for Case No. 4367, asked for authority to drill two locations for water injection wells, one was at a standard location and one was at a non-standard. So we took the non-standard location and included it in 4368, which was for the conversion of 13 wells at standard locations. Now, it appears that our efforts to streamline this may have resulted in a little bit of difficulty

in handling, and I am wondering if the interested parties would be willing to stipulate that Case No. 4367 would be for two wells to be drilled, one at the standard location and one at the non-standard location, and Case 4368 would concern itself only with the conversion of 13 injection wells.

MR. LOPEZ: That would be agreeable to us.

MR. NUTTER: At this time, I would like to ask for appearances in these two cases, 4367 and 4368.

MR. LOPEZ: My name is Owen M. Lopez, with Montgomery, Federici, Andrews, Hannahs and Morris, on behalf of Marathon Oil Company.

MR. KELLAHIN: Jason Kellahin, of Kellahin and Fox, appearing on behalf of Continental Oil Company. We have no objection.

MR. LOPEZ: Mr. Examiner, I would like to introduce Jack McAdams, counsel for Marathon from Texas.

MR. NUTTER: Do we have any other appearances? We have three appearances, then, Mr. Sperling on behalf of Mobil; Mr. Kellahin on behalf of Continental Oil Company; and Mr. Owen Lopez and Mr. McAdams on behalf of Marathon.

Are all three parties willing to stipulate to the inclusion of two wells to be drilled in Case No. 4367, and 4368 to concern itself only with the conversion of 13 existing wells?

MR. SPERLING: Mobil will join in the stipulation.

MR. NUTTER: In this case, we will proceed with our hearing of the two consolidated cases, and the order will be entered as described beforehand.

MR. SPERLING: I might inquire, Mr. Examiner, as to how you want to receive the exhibits. We have an area map which, of course, would be pertinent in both cases and it would be my suggestion that we mark a copy of the large area map in both of the cases and then mark the additional exhibits as appropriate in view of the stipulation and the implication of the two applications.

MR. NUTTER: This would be Exhibit No. 1 in each of the two cases?

MR. SPERLING: Yes, sir. I believe my appearance for Mobil has already been noted. We have one witness in these cases.

(Whereupon, Applicant's Exhibits
1 through 5 were marked for
identification.)

(Witness sworn.)

PAT KELLY

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

DIRECT EXAMINATION

BY MR. SPERLING:

Q Please state, for the record, your name, place of

residence, your employer and the position in which you are employed.

A My name is Pat Kelly. I live in Midland. I work there for Mobil Oil Corporation as a Petroleum Engineer.

Q Have you on any previous occasion, testified before the Commission so that your qualifications as a Petroleum Engineer are a matter of record?

A Yes, sir.

MR. SPERLING: Are Mr. Kelly's qualifications acceptable?

MR. NUTTER: Yes, they are.

Q (by Mr. Sperling) Mr. Kelly, by way of background pertinent to these two applications which have been consolidated for the purpose of testimony, would you please give us a brief history of the production, both primary and secondary, that has occurred in the area, which is the subject of this hearing?

A San Andres production was established in the Vacuum Field, in 1929. Primary production was under solution gas expansion. There is possibility there is some water drive in the south end of the field. The field has produced 125 million barrels of oil to the end of 1969. Development of the Bridges State lease, State G, and State J leases, which are involved in this application, began in the 1930's. Most of

the primary reserves had been produced by the late '50's or the early '60's. A pilot waterflood operation was started on the Bridges State lease by injection through six San Andres wells located in Section 14, in forming part of the lease in December, 1958. That pilot operation was expanded to two more wells, one in Section 23 and in the other injector in Section 14 in 1963.

The performance of the expanded pilot, subsequent to 1963, justified a further expansion of injection operations to a total of 30 injection wells, late in 1967. The 1967 expansion extended down to the south lines of Sections 22, 23 and 24, generally speaking.

This application today is concerned with expansion of that waterflood to include injection wells covering the balance of the Bridges State lease on the south end. Some 2,236,000 barrels of oil have been produced from the San Andres formation on the Bridges State, State G and State J leases, since waterflooding operations were started in late 1958. Approximately 1,150,000 barrels of that oil is attributed to the waterflooding operation.

Q Now, for the purpose of identification, would you please refer to what has been marked as Exhibit 1 in both case 4367 and 4368, and identify that, please?

A Exhibit 1 is what I would call an area map of the Vacuum Field. It shows situated on it all of the wells that had been drilled or completed in that area up to January, 1970, which is the last date the plat was brought up to date. It shows, in the approximate center of the map, the Bridges State lease, which is the subject of this hearing. It covers all of the ownership and development within two miles of the Bridges lease.

Q Now, also for identification, refer to what has been marked as Exhibit 2 in both cases and explain what it portrays.

A Exhibit 2 is a small area map covering the Bridges State, State G and State J leases, in addition to acreage offsetting those leases. It shows, according to the legend, the injection wells which are currently in service as a result of the earlier flooding efforts. It shows, in red triangles, the injection wells which are requested for approval in these two applications and it shows in open triangles, on the north end, proposed injection wells which we will be extending lines to in cooperation with the offsetting Gulf Oil Corporation on the Lea State F E lease and the Yates Drilling Unit Flood, which was recently approved by the Commission.

We will expect to make application for administrative approval of those injection wells, following the approval of

these applications, part of which is an application to allow further expansions on an administrative basis, without the necessity of demonstrating response to waterflooding in the expansion area.

All those injection wells indicated on the north end of Bridges lease proposed for injection in the future are covered in a cooperative agreement which has been executed between Gulf, Yates and Mobil.

Q Now, would you please identify the location of the wells which are the subject of the application in Case No. 4367? Those are the two wells to be drilled, proposed to be drilled?

A Yes, sir. There is a well proposed for drilling for injection use, 330 feet from the south lease line in "E" location of Section 25, another well is proposed for drilling 100 feet from the south lease line in "N", location of Section 26.

Q And explain briefly the relief sought in application 4368.

A The application covered in Case No. 4368 is for the purpose of extending the flood to include injection authority in the remaining 13 red colored wells on Exhibit 2, all of which are at regular locations, all of which, with the exception of well No. 132, have been produced, or have been developed at some time with a producing well in the San Andres formation.

I might point out that there is no San Andres well in Unit E of Section 25 at this time. There are two wells at this time, one is completed in the Blineberry and the other is a Glorieta well.

Q Now, do the wells which are shown on Exhibit 2 represent San Andres wells or other wells drilled or completed in other formations?

A Exhibit 2 shows all of the wells that have been drilled insofar as we know of them, that have been drilled on this acreage. It includes wells completed in various reservoirs down through the Pennsylvanian. I believe there are a couple or three more wells indicated on the north end of the lease. For example, there have been twin or triplet wells drilled on different units at various places over the lease. They are completed in different arrangements. We do have logs on recently completed wells; the original San Andres wells we have only a few logs on.

Q These were the wells that were drilled in the late 30's?

A Yes, sir.

Q What completion method was used with respect to those wells?

A Most of those wells were open-hole, casing set up

that's what I would expect to happen.

Q Do you have anything else to add at this time, Mr. Kelly?

A I believe not, sir.

MR. SPERLING: At this time I would like to offer Exhibits 1 through 5 in Case No. 4368 and I believe we have two exhibits to offer in 4367.

MR. NUTTER: Exhibits 1 and 2 in case No. 4367 and Exhibits 1 through 5 in Case No. 4368 will be admitted in evidence.

MR. SPERLING: I believe there is a third exhibit in 4367 which includes the well sketch insofar as the completion and proposed wells to be drilled, which is substantially the same. They may not have gotten separated properly.

MR. NUTTER: Exhibit No. 3 in Case No. 4367 will be admitted in evidence.

(Whereupon, Exhibits 1, 2 and 3 in Case No. 4367 and Exhibits 1 through 5 in Case No. 4368 were admitted in evidence.)

MR. SPERLING: That's all we have.

MR. NUTTER: Does anyone have any questions of Mr. Kelly?

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Kelly, on looking at Exhibit No. 5, it seems to

in the San Andres somewhere, or Grayberg and/or the well completed natural if sufficient fluid entered the hole. If not, most wells were shot with nitro glycerine and most of them do have shot holes.

Q Now the Exhibit in Case 4368, marked 3, appears to consist of a number of logs. Would you explain what logs those are or what they consist of?

A Those are the logs that we have available on proposed injectors, covering this application. They have been marked to show the San Andres porosities that we expect to take water.

Q I believe I understood from your previous testimony that the waterflood operations conducted to date have been quite successful, is that correct?

A Yes, sir. The initial pout at the outset was not very successful. For several years water was introduced into the San Andres and at low volumes and at low pressure. There is in the north end of the Bridges State lease what I describe as a high porosity or high permeability streak within the body of the pay. It varies in thickness from 10 to about 20 feet and is found in a good many wells on the north end. It took water very readily, I think, at low injection pressures and is not flooding the balance of the rock.

In 1963, when the flood was expanded, we kicked the

injection pressure up pretty high and increased the rates and were successful in getting, I believe, some water into the tighter rock and as a result we produced quite a lot of waterflood oil up there.

Q Now, is production represented by Exhibit 4?

A Exhibit 4 is a graphical history of flooding operations since the first of 1966. It shows where injection increases in the '67 expansion. It shows that oil production increased to about 1200 barrels per day, approximately 18 months after the flood was expanded in 1967 and the last six or seven months' production has declined to about 920 to 940 barrels per day on the lease and it appears to be maintaining steadily at that level.

Q Now again with reference to Case No. 4368, would you explain the conversion procedure which you would expect to follow in connection with the wells indicated on Exhibit 2 to be converted?

A Most of these wells have already been converted. They were converted by cleaning out, cleaning out the well to the base of the porosity that we wanted to inject into and the running of cement line tubing set on a packer up on the casing. In one or two cases, we re-entered wells which had at one time been San Andres wells and had been deepened to other horizons

and depleted and we re-completed in the San Andres as injectors. We have re-completed those casings, we have drilled Bridges State this spring as an injector and completed it through perforations.

The casing annulus above the packer and behind the tubing has been loaded in each case with treated water. I might say that all the surface facilities, distribution system and injection and station piping is cement lined and most of it is in the ground right now.

Q Does Exhibit 5 in 4368 represent the completion of conversion procedures to be followed in the wells which are the subject of the application in that case?

A In case No. which, sir?

Q 4368.

A 4368. Exhibit 5 is a package of well-bore sketches portraying the completion method or condition of the wells after they have been converted. Most of those portray conditions as they are at present because the wells have actually been converted and a few of them, two or three, have not been converted yet and in those instances the sketch shows how we expect it to be, and, of course, in the case of the wells which we plan to drill, the sketch shows we expect to case through the pay and perforate for injection in the selected porosities

and that we will be injecting through cement-lined tubing set on a packer above the perforations.

Q Well, is that the completion method you anticipate to be used in connection with the two wells proposed to be drilled?

A Yes, sir.

Q That are the subject of 4367?

A That's right, so, essentially, the --

Q Methods to be employed are the same?

A Yes, sir. Where there is casing through the pay, it is perforated, or will be perforated, and where it's open hole, the packer is set up in the casing and we are injecting out the bottom of the casing.

Q You have mentioned previously the injection in the selected areas of porosity. How do you propose to select those areas of porosity?

A We have done quite a lot of geological work in the last year or two on our property here and have identified two principal sources of production. what I describe as an Upper San Andres porosity and a Lower San Andres porosity. The Lower San Andres porosity has been and will be perforated in, cased injection wells where the casing runs through the pay where that porosity is above what we have found to be the oil-work

contact in this area, in that zone, where there is indicated to be oil, recoverable oil, in the pattern that that injection well is going to serve in that porosity and, of course, we will perforate from the upper porosity, too. In the case of open hole injection completions where we have formed the opinion that the lower porosity could contain oil at a location, or within a pattern, we have deepened those wells so as to expose the lower porosity to injection.

The upper porosity is open in all wells and until recently the lower porosity has not been opened in all the wells.

Q Is there any separation as between these two porosity zones, that is, by any sort of impervious substance?

A Yes, sir, there is a combination of shale and limestone, or dolomite intervening between the two porous intervals on the Bridges State lease, at least I would have to refer to a specific well to give you my opinion of the exact interval between them but, in general, it's about 200 feet, vertically, between the two porosities.

Q Well, do I understand that you will be selective insofar as the point of injection in a given area of porosity?

A Yes, sir.

Q By well?

A We have been selective and we will expect to be selective in the future.

Q Now it appears from Exhibit 2 that this flood pattern follows the five-spot, ordinary five-spot pattern, is that correct?

A That is the pattern we started with in the pilot and we have found no reason to change it.

Q Now the two wells which are proposed to be drilled in Case No. 4367, which I think you identified as being located respectively in Sections 25 and 26, Unit "N" in 26, and Unit "E" in 25, are these wells required in connection with the preservation of the integrity of the pattern you have developed the flood on?

A Yes, sir, the well in Unit "E" of Section 25 is required because there is no well there, well-bore there available, for use to inject into. If the recoverable waterflood oil is to be produced, it will be necessary to close up the south end of that pattern with an injection well.

At this point, I might say that we have approached, through the mails, the offset operators to the south, Marathon, Continental and Texaco, in an effort to obtain lease-line cooperation in cooperative flooding operations. We offered to provide those parties with pressured water from our system

to inject into their wells which would complete the patterns that we have been butting up against the lease line. In the case of Texaco, who operates a unit offsetting to the south, that portion of the Bridges State lease which is found in Section 27, it is my understanding that and, it is I think public information, that they do have a waterflood under way on that unit. I forget the name of that unit, I believe the west Vacuum unit. They have a sparse injection well network and I believe they have learned that it is going to be necessary to inject a lot more water than they have been injecting, and have plans for expanding that flood to a five-spot pattern which would merge very well with the pattern that we have on the Bridges lease.

MR. NUTTER: Is it their intention to put that Arco Well No. 13 in Unit "A" of Section 34 on flood, or do you know?

THE WITNESS: It is my understanding that Texaco intends to convert Well No. 13 which goes by some other number, namely in the unit.

MR. NUTTER: That well in that forty-acre tract would be converted, then?

THE WITNESS: Yes, sir, but they have not indicated when this would be.

MR. NUTTER: Is the Phillips lease to the west part

of that unit, do you know?

THE WITNESS: I don't believe it is.

MR. NUTTER: Go ahead.

THE WITNESS: There is some question of when the budget funds will be available to do the work. It is a fact that the work is planned to be done. At this point, I have confidence, at least, that the well indicated, No. 13 in the Northeast corner of Section 4, will be converted to injection in time, to let us sufficiently flood our property.

With respect to Continental and Marathon, the letters that we wrote resulted in refusals or, or in other words, they both declined to participate in a cooperative waterflooding venture. I found no trouble in understanding why Marathon did not want to participate as their wells, my research had told me, were approximately top allowable wells and there was little incremental right to be gained by expanding the flood onto their property. My research indicated to me that some of the Continental wells in Section 35 had declined in productivity somewhat and could be helped by joining in the waterflood effort and so we approached them then through the mail and after some time, I'll say a period of several weeks, or perhaps a few months, we received another reply which said they had looked it over, in so many words, looked it over carefully, and couldn't

bring themselves to participate.

It was at that point that I began to be concerned about this waterflood, that we were in the process of expanding, producing the waterflood oil that it had to produce to generate the economics that justified the work because we did have some hope that we would gain lease-line cooperation and swap out the reserves that would cross the lease line.

All of our wells that are currently drilled along the south lease line and are proposed for injection are approximately 660 feet from the line. On top of that, the fact that no injection would be taking place to the south caused me to conclude that the ordinarily recoverable waterflood reserves in the north half of those patterns would not all be produced by the producing wells serving those patterns, if the patterns were allowed to remain open on the south.

I finally determined that we, in order to maintain the integrity of our flood on the south end, that it would be essential to have injection take place south of Well No. 26 for two reasons: to insure a reasonable opportunity of Mobil producing through Well No. 26 the recoverable waterflood reserves underlying its property in that pattern and to insure that the otherwise recoverable waterflood oil that would be pushed south of Well No. 26 outside the influence of a producing well-bore would be recovered at all, because it's my opinion

it will not be recovered at all because I expect to stop injecting when No. 26 reaches the economic limit and whatever oil has been pushed out of it will not be recovered.

Q (By Mr. Sperling) Now what governs your decisions as to the rate of injection, say in the pattern proposed, pattern in Section 26?

A On an average, our injection facilities and lines are designed to accommodate about 700 barrels of water per day per injection well because some wells have thicker pay exposed in them, and some thinner pay. I expect that the injection into those wells will range up and down and in proportion to the reservoir volume that I estimate is within those patterns.

In each case, insofar as it is possible, it will be my intention to bring about injection into each of those wells which will tend to flood out the pattern from all directions at approximately the same time.

Q Well this suggests then that if an injection well is further removed from the producing well in the pattern, that the injection rate, assuming some uniformity of pay section, the injection rate would be greater than the rate in a well which is located closer to the producing well, is that correct?

A Yes, sir, that's correct. Given uniform conditions,

indicate most of your proposed conversion will be completed open-hole?

A Yes, I think that's true.

Q And that your well No. 132 is perforated and open-hole 4912 feet?

A I believe that's correct. If you are looking at the exhibit, I will accept it.

Q Now, you propose to drill an injection well in Section 25 of Unit "E". How will that well be completed?

A In accordance with the sketch which was submitted in that case, a copy of which is on top of this package that I will hand you, the well is expected to be completed through perforations with pipe set through the pay.

Q Now, would those perforations from 4500 to 4850 feet cover the entire producing horizon in the Vacuum and San Andres River Field?

A I think insofar as I understand, the oil pay to be present, that would encompass the lower pay, that's if it's there; I don't know that it is.

Q You don't know if it is in that particular area or not. Do you know what zones Continental oil wells are completed in?

A I have searched the records the best way I know how and insofar as I have been able to determine, some of the wells

are completed open-hole through the upper and lower porosities and some of them --

Q Would that take it down to 4850 feet, is that the lower?

A Yes, sir, I think some of them are probably getting production out of the lower porosity and I think that one of them may not be getting production out of the lower porosity.

Q That is the zone you would deflate?

A To the extent that it is oil-bearing on our property. We have found, for example, that several of our wells penetrate that lower porosity below water and we will inject into those wells that did find water in the lower porosity only in those cases where it is indicated to be oil-saturated within the pattern that will be served by the injector.

Q Well, you don't know whether that situation exists on Continental's lease? You are talking about what exists on your own lease?

A I didn't follow you.

Q I say you don't know whether you found oil saturation on Continental's lease or not.

A I don't know what Continental has experienced with respect to the production out of that lower porosity. I know the work we have done indicates that some of Continental's

wells penetrated the lower porosity below water. But I know they've made a great deal more oil than our wells. In general, the production improves dramatically south of Mobil's lease line.

As a matter of fact, a number of wells have been deepened and have been made good producers and through the scout tickets I have been able to turn up, most of those wells penetrated a sufficient depth at the outset to uncover the lower porosity that I am concerned with.

Q When they were initially drilled?

A Yes, sir.

Q Now you stated that your production was about 940 barrels a day from this project, is that correct?

A Currently, yes, sir.

Q What water are you producing?

A In the neighborhood of currently 2200 barrels per day. It is a little difficult to break that precise volume out because we do transport water production from other zones into our system and I rely on the produced water meter, rather than the produced water estimates based on well tests for plotting my data. It may be that the reports made to the Oil Conservation Commission carry a different water production figure than I have plotted on this graph. I have more confidence in the metered column being correct than I do in the allocated

volume based on well tests.

Q Now you testified, I believe, that you increased the pressure in 1963?

A Yes, sir, a long time before that. I think we were flooding the, what I have termed the high porosity streak, the best streak of high quality pay in the body of the main pay and I do not believe we were flooding the balance of the reservoir.

Q You are still flooding that, are you not?

A Yes, sir.

Q Have you ever run an injectivity profile on these wells?

A Yes, sir.

Q What zone appears to be taking this to order?

A The injection profiles that we ran were confined to the pilots. I haven't run any outside the pilot; it's been a few years since I ran one up there, but intervals ranging between 15 feet and 250 feet were indicated to be taking water at different times and under different conditions. I can't say that I have drawn any correlation that I can speak intelligently on today which would demonstrate that the profile or the degree of sensitivity that profile has to injection pressures.

I have the opinion that the higher the injection

pressure is, the more pay we will get water into, as a general thing.

Q Now, there are actually a number of porosity zones in this pool?

A The point that we are flooding in the north end has just the upper pay and it thins quite a lot on the north.

Q So your injectivity profile would be confined to the upper pay, is that correct?

A Yes, sir.

Q Is that where you ran your profile?

A Yes, sir.

Q You don't know what the situation is in the southern portion?

A I don't know the situation with respect to what?

Q With respect to the injectivity of the various zones.

A No, sir, we haven't injected in the south end and run no injection profiles in there. I have the opinion that, from what I can see of the logs, that the second porosity is much higher quality, generally speaking quality, than the first porosity and I would expect to take water more readily in the first porosity.

Q You testified you propose to make a lease-line

agreement with Continental Oil. Are you familiar with the correspondence?

A Yes, sir, I wrote the correspondence, some of it.

Q What wells did Continental require to convert to water injection?

A I don't have the correspondence in front of me so I can't tell you for certain, but I would say that the well situated immediately south of the well that we propose for drilling in Unit "N" is one of the wells that we asked Continental to convert and, let's see if there is another. I don't recall whether we asked them to convert another or not. It's probably No. 2 well in the northeast.

Q Do you know what those wells are presently producing?

A No, sir. At the time that the correspondence was initiated, I have some faint recollection that the well to the west, which is probably well No. 6, was making something like ten or twenty barrels a day, but that is only a faint recollection.

Q Now, do you have any recollection as to what the volume is that is proposed to be converted?

A That is the well I am talking about.

Q That's 6, ten barrels?

A Yes, sir. I have the production records here. You can refer to them. There is no need to guess.

Q Now, you stated in your opinion it was essential to drill the wells, this particular well in Unit "E" of Section 25 to protect your flood pattern because there is no well there. Does that requirement include a requirement that you drill one hundred feet from the lease line?

A I apologize for not following you, sir. I was referring to the production data. At the end of 1965, Well No. 6 was making on the order of ten barrels a day, ten to fifteen barrels a day, throughout that year. It ranged from below ten barrels a day up to fourteen or fifteen barrels a day, according to the production report that I am looking at here.

MR. NUTTER: What is the total for the year from the well?

THE WITNESS: 3994.

MR. NUTTER: That is No. 6?

THE WITNESS: No. 6, yes, sir. The total for No. 2, which I see was a much better well, was 17,719.

Q (By Mr. Kellahin) How many barrels a day?

A It was making 50 or 60 barrels a day toward the end of the year.

Q Now to get back to my next question. You say in your opinion it's essential to protect the integrity of the waterflood

pattern to drill the well in Unit "E", does that include the drilling of the well at a hundred feet from the lease line?

A Yes, sir. The closer I drill that well to the producing well, the more likely I am to prematurely flood it out with injection into that well.

Q Now, isn't the converse true?

A I wasn't through. And, of course, I would like to produce as much as possible. The recoverable waterflood reserves that lay underneath Mobil's lease, and a hundred feet from the line, is just as close as I felt obliged to ask the Commission to approve, that's all.

Q The closer you get to Continental's wells, the quicker you will flood it out.

A Assuming there is communication laterally between the wells, I think that's true, and I am willing to assume there is interchange of fluids in there. I assume Continental's wells have produced a great deal more oil than Mobil's wells have and there is something which happens, I believe, to the pay in the area intervening between Continental's lease and Mobil's lease and, for that matter, Marathon's and Mobil's lease.

Q You wouldn't consider it an effective barrier?

A I don't represent that it is, no, sir.

Q If it were, it would be an ample back-up for your flood, is that right?

A That's right.

Q Now what would be the result of not placing this last row of wells --

A It depends on how close it is. If it were close to the producing well, it would be satisfactory.

Q What would be the result of not placing this last row of wells on injection in the absence of a lease-line agreement?

A Well, I haven't calculated the volume, but in general, it looks like we would be cutting of a third of the south end, a third of those two Mobil's acreage in Sections 26 and 27 from any flooding at all and would be subjecting the wells in the center of that section, namely 33 and 39, to production from open patterns which would result in some part of the recoverable oil in the north part of those patterns being pushed out to the south where energy to getting it into a producing well bore would be pretty scarce in the absence of

injection, and speaking generally, I'll say that the sizeable share of the oil that we would expect to produce from this waterflood expansion would not be produced short of converting those wells to injection along the south line.

Q You say would not be produced, would not be produced as a result of the waterflood pattern; you would then have although a subsequent injection program could be installed could it not?

A I will allow that the economics of any situation can be developed which will allow you to take certain steps at one time or another. The economics of the flood expansion that we have currently underway will not allow the south end of that lease not to be flooded at this time. The south end of the lease, in fact, in general, the wells in Sections 25, 26 and 27 are at or below the economic limit at the present and it is a matter of getting with it or getting without it.

Q You would still have a flooded Section 25 if you omitted the last row of injection wells, would you not?

A It would be a puny effort. I can see that we would have, we would gain two patterns, two complete patterns, if we did not complete the south row of injection wells in this expansion.

Q But those wells would remain on production and would

get the benefit of injection to the north, would they not?

A I don't know to what extent they would get the benefit of injection.

Q You have not calculated that?

A I assume they may get some.

MR. KELLAHIN: That's all, thank you, Mr. Kelly.

CROSS EXAMINATION

BY MR. LOPEZ:

Q How many wells are producing in the current flood zone?

A If memory serves me, I believe 61 San Andres wells on the lease that are currently producing.

Q Could you tell me what the average production per well is per day?

A I could divide it out for you. We are making 940 barrels a day from the lease, and I didn't bring the slide rule, but -- gosh, --

Q I direct your attention to your wells 13 and 11 that offset Marathon's wells No. 2 and 4 in Section 25. You have stated, I believe, that both of these wells are drilled to the Blinberry formation and the other to the Glorieta?

A I am certain that Well No. 13 is a Blinberry completion. My memory is hazy on where Well No. 103 is completed, but I

believe, it is the Glorieta. Those are both profitable wells where they are complete and they are not available to me in this expansion.

Q In the injection well you propose to drill near your Well 13, which offsets our Wells 4 and 2, I would say, you propose only to go to a depth of 4850 feet, is that correct? I believe you have it on your Exhibit 5.

A Well, the sketch shows schematically what we expect to take place. I expect to stay straight as I can. I expect we will want to inject into all the oil-bearing porosity that we find if and when we drill that well, that is such porosity as underlies our lease. Now, with the available of quality logs being pretty scarce, I think we'll get more information on what the well penetrates from the log of the well itself than we will by speculating as to what is there or where the porosity is found.

I don't know precisely where it will come in. The work that we have done indicates to me the second porosity will probably all be above 4850 feet, yes, sir.

Q This, of course, will mean you will have to convert your 13 and 11 wells to take advantage of this flooding action?

A No, sir, I don't intend to say that. Wells 13 and 103 are profitable wells, where they are completed, and I will expect

us to continue producing those wells in the zones to be completed in. I don't expect them to be completed in the San Andres.

Q That will entail, necessarily, Wells 11 and 16 that you believe will be advantaged by this drill and 33 and 16 from the San Andres?

A Thirty-six. I believe we have re-completed 36 in the San Andres, I am not clear on that. It is the well we intend to produce on the San Andres on that pattern.

Q Sixteen?

A Sixteen is up in the northwest quarter of the northeast quarter of 25, and I don't expect any straightforward help for that pattern from injection into the proposed well to be drilled.

Q I believe Mr. Kellahin already has indicated, has asked you, you cannot be certain that if you do propose, if your application is granted, that the flooding will not affect our Marathon's well in the section directionally south of this well site?

A It's true that I can't be certain of whether or what the effect will be. From what I have seen, I have the opinion that there will not be a great deal of effect on Marathon from injection into that well. We do have a log on 103 which would be a west twin to the well that I want to drill and while I wish there were second porosity there, I don't see it on the log so

I don't know whether we have it there or not.

Q Now I direct your attention to Well 25 which you have proposed to convert into an injection well. This is an open well at the present and is it your proposal just to drill that deeper?

A Well 25 was drilled initially to a depth sufficient to expose the second porosity. At some period in its history it was jumped and at this time does not have the second porosity open. I will be evaluating that well for a work-over to get the second porosity open that because I believe that it contains more saturation in the upper parts of it.

MR. McADAM: Mr. Examiner, could I also ask some questions?

MR. NUTTER: Certainly.

CROSS EXAMINATION

BY MR. McADAM:

Q Do you know what depth Marathon's wells are on in the State of New Mexico, McAllister Lease, that are now producing, from what porosity zone?

A No, sir, I don't know what they are now producing. I have available to me the scout tickets, I suppose covered the initial drilling and completion operations.

Q As I understand, you propose to drill this well as a

direct offset to our No. 4 Well, to a depth of 4900 feet, is that correct?

A Well, sufficient to be sure that we have given the well a chance to penetrate the second porosity, if it's there.

Q As far as you know, there is just two porosity zones in the San Andres?

A Just two we have oil out of. There are a lot of San Andres porosities.

Q At what interval is the lower porosity found?

A Well, I don't have the data in front of me to tell precisely where it is. Let's see if I can give you an estimate. No, I don't have the information in front of me to tell me that. I think it's -- if what I have been calling second porosity is there, unless something unusual has happened geologically in the intervening area, it ought to come in above 4850 feet.

Q Do you know where the second porosity is found in your Well No. 13?

A No, sir.

Q I think it's drilled to the Blinberry. Do you have a log on that well available?

A I don't recall whether 13 was logged or not. I have been using a log on 103 which is about 330 feet south of 13 and I don't find any second porosity in 103 and the upper porosity

is pretty skinny there. I will be hoping for more than that thing shows.

Q So in your opinion, this second porosity is not found in your Well No. 13?

A It probably is not, if I can rely on the log, Well 103 as indicated is what is present in that area. Of course it may be the log's not any good.

Q Do you know what depth this so-called second porosity zone is found anywhere in this field?

A I have to refer to a log. If I can lay my hands on the log of Well 25, I can tell you where it is on that well. Let's see -- I think I know where it is in 132. In order to be absolutely certain, I would have to correlate with the log I have marked. I am looking at a Gamma Ray Neutron Log on State Bridges No. 25. I didn't run across the log of 25, and I see on that log a porous member which extends approximately 4694 or 95, on down to about 4720, something like that.

Q That is what you refer to as the second porosity?

A That is what I have been calling the second porosity.

Q Let me ask you this. Do you consider this lower zone more porous, more permeable zone, than what you have been encountering in the northern portion of your State Bridges lease?

A It looks a lot cleaner on the log, yes, sir. I think

it is better pay on most of the logs.

Q It would be more receptive to water injection?

A Yes, sir, I think the water will enter in proportion to the thickness and the permeability.

Q And it should enter better in the lower zone and should extend further and project the output further?

A I don't know that I can make that as a statement. I said it would enter -- I would expect it to enter in proportion to the thickness and the permeability. I would have to do some figuring to see if it would progress more rapidly in feet per second laterally in one than the other.

Q You would expect that -- it seems to me like it's more permeable, more porous, that the water is going to move better just as in the case of oil.

A I apologize for it not being clear to me right now.

Q It's not clear to me either. The other question I have -- on this offset here to the Marathon State of New Mexico McAllister lease, I didn't get while ago exactly what well is to be influenced. Did you say Well No. 36?

A Yes, sir, I believe 36 is the well that we have projected for our San Andres production in that pattern. Of course, it will influence No. 11 and Well No. 27.

Q Is Well No. 11 a Blinberry well?

A I believe that No. 11 has been substantially depleted of its Blinberry reserves and has been or is scheduled to be completed in the San Andres, although I will let the records correct me if I am wrong, we do have a producing well scheduled for that location and it is one of those three.

Q I thought you said a while ago that 11 and 13 were not scheduled.

A No, sir, I said 13 and 103 are producing from other horizons and they are making profit where they are.

Q How is this going to affect your existing pattern, your so-called --

A How is what going to affect it, sir?

Q -- the drilling of this well.

A It's going to close up the south end of the pattern that will be served by producing Well No. 36. It will close up the east side of the pattern that will be served by producing Well No. 27 or some other well that will be located. Twenty-seven produces from another horizon and it will be served by the producing well at the location of No. 11 to the east of the well. There are one, two, three producing wells that I expect to be influenced by injection into the proposed injection well.

Q Seventeen will be influenced by it?

A Seventeen? Seventeen is a proposed injection well in

the extreme northeast corner of Section 25.

Q Do you think 16 would be influenced by it?

A I think there is a possibility. Crazy things happen when you start injecting water. I don't have reason to think it will.

Q On any of those open hole completions, how do you control that water?

A By volume and pressure.

Q Volume and pressure, but you can't control the zones that it is going to enter into?

A Well, the zones themselves control that, if they're porous and permeable --

Q You can't tell the Commission which zones have been receptive nor can you say that since the early history of this field have you run any surveys to establish the course which this water has taken?

A I testified earlier that we have run a number of profiles in our pilot that if you rely on tracer surveys that show where the water went and it went into the pay.

Q Which pay?

A The pay that was exposed to the well bore, the upper pay.

Q Have you experienced -- let me ask this question --

how much oil do you think that you will lose, that you would lose, by backing up that proposed injection well off from Marathon's lease by, say, another 660 or 330, leaving off that last tier, how much would you lose there?

A If I would back off to 660 rather than 330? I haven't formed an estimate of that. I think there -- well, I ought not to speak from memory. I have calculated the incremental area and I don't remember what it was. I think it was thirteen or fourteen acres, it seems.

Q What amount of production would you say would be lost at that location should you adopt the suggestion that was made by Mr. Kellahin, backing it off, leaving off that last tier of wells, and particularly moving this one up?

MR. SPERLING: Which wells are you talking about, Continental's or yours?

MR. McADAM: I am not talking about mine, the one offsetting --

A The one well?

Q (By Mr. McAdam) -- the one well, moving it up.

A To 660 or not digging at all?

Q 660.

A I haven't made an estimate of that quantity of oil.

Q Excuse my ignorance. When you have a water break-

through, what actually occurs in the reservoir?

A I'm not sure precisely what occurs in the reservoir. I have the opinion that when water breaks through prematurely it is because there is some avenue of effective communication which is all out of proportion to the balance of the reservoir, of the rock. I think this is what happened on the north end in the early days.

Q Oil is left behind -- you mean it breaks through the oil column or fractures the reservoir, just leaves behind oil?

A Speaking in generalities, sometimes I think you can fracture impervious rocks and extend it with injection water. I don't think you can extend a fracture that is already there and permeable in porous rocks and thereby cause a channel in the area up north. We have enough information to convince me that there is a zone of very high, relatively speaking, high permeability within the body of the pay which correlates between wells and is generally present in some areas and those are the areas, by coincidence or whatever, that have experienced the water break-through. I attribute it to that zone being more permeable. I don't believe that we've communicated between wells with fractures, induced fractures.

Q You don't think you have had any fractures?

A No, sir.

Q At what pressure do you think this reservoir at this stage would fracture?

A Somewhere in the neighborhood of twenty-six or twenty-seven hundred pounds at the surface, and that's sort of a guess at this point. I have made computations in the past and that's the order of magnitude of fract pressure that sticks in my mind. We have fractured a good many wells, well several wells, in the north end, and found variable instantaneous shutins after the fract treatments which I will say have gone quite a lot above the pressure that this system is designed to handle, which is 2500 pounds.

Q In your list of exhibits, do you have any cross-sections?

A I haven't offered any cross-sections.

Q You mentioned a while ago that you had requested that Marathon enter into some cooperative plan?

A Yes, sir.

Q What was the proposed plan?

A I can't tell you in detail what it was. I can speak generally and say that Marathon was invited to convert a well or wells to injection offsetting the Bridges lease, with the understanding that Mobil would be willing to provide pressured waters for injection into that well or wells and delivered at a point, at some convenient point, for pickup. I think that was

probably Well No. 3, but I don't have the correspondence in front of me and so I can't -- I believe it was Well No. 3. Perhaps Well 2 and 3, it looks like, would close up that pattern. Those are probably the wells we asked you to convert.

Q 2 and 3?

A I don't have the correspondence with me and I can't tell you for certain. I believe that is -- that would close up the pattern. That's the logical thing that I would ask be done.

MR. McADAM: I think that's all I have.

MR. NUTTER: Take a recess until 1:30.

(Whereupon, a recess was taken.)

MR. NUTTER: The hearing will come to order, please.

Does anyone have any further questions of Mr. Kelly?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Kelly, I note from all your schematic diagrams of wells that have been completed and wells that will be completed, injection wells, that in each case you are using cement-lined tubing packers?

A Yes, sir.

Q What is the treatment of the annulus by Mobil Oil Company?

A It's a solution of water and chemicals that goes by the trade name of Crotron.

Q In other words, you do use a corrosion inhibited fluid in the annulus?

A Yes.

Q And you are going to equip that with a pressure gauge at the surface?

A Yes, sir.

MR. NUTTER: Are there any other questions of Mr. Kelly?

MR. SPERLING: I have a question or two on redirect.

REDIRECT EXAMINATION

BY MR. SPERLING:

Q Mr. Kelly, I think there was some reference in your direct examination, or possible cross examination, about a water break-through experienced in the northern part of the Bridges lease which is shown on Exhibit 2, is that correct?

A Where specifically, did that occur?

A It occurred in and around the old pilot which was developed with injectors numbered two, thirty-seven, fifty-six, sixty-four, sixty-six, and seventy-one. Of course, it was later expanded to injection wells thirty-one and sixty-two. The premature water break-through occurred in the center

producer Well No. 34 of that pattern, described by injection Wells 2, 31, 37 and 62.

Q Now has that condition continued or has it been corrected?

A I think we have just about corrected it. The Well No. 34 had gone to a very high water clay, essentially watered out. After we expanded the operation and to increase injection pressure, we began to make oil out of it again. At the present we are making something in the neighborhood of 30 to 40 barrels of oil and 50 to 60 barrels of water per day out of the well, when it is on production.

Q So the fact that there was a water break-through initially or at the time of the pilot doesn't indicate that the production from that well or the area swept and produced through that well was lost, does it?

A No, sir, the other offset well, the No. 61 up to the northeast, which is in the original pilot, also suffered premature water break-through and it also has come back around and is making a decent oil cut at the present.

Q Well is the conclusion then, that there was no oil or substantially no recoverable oil by secondary methods left behind as a result of that break-through?

A The break-through did not result in us losing the

oil, recoverable oil that was still in the rock, no, sir. I think if we had not changed our techniques some that we could have lost it but we didn't change them and we have taken some other remedial measures, too, which have been helpful in our achieving a very decent recovery. I think we'll get a good recovery out of the whole pilot area.

Q Now, there was reference in direct examination or cross examination, to production figures relative to the flood project. I want you to refer to what has been marked Exhibit 4 in Case 4367 and tell me what that is.

A That is a tabulation of oil, gas and water production since 1960 for all of the wells which are within one location of the southline of the Bridges State lease to the extent that those wells are situated on the Bridges State, the Continental's H-35 and the Marathon-State-McAllister leases. It shows a cumulative oil to January 1, 1960, together with annual oil and gas for the years 1960 to '68, and monthly oil, gas and water for the years 1969 and 1970 up to the latest reports that are available.

Q Now where did those tabulations come from?

A They came out of the New Mexico Oil and Gas Engineering Committee's Annual Report and other Reports of the Committee.

Q Now, have you made any calculation as to the oil that

would be left unrecovered if the pattern in Section 26 on the south portion of that section by leaving the pattern open, by failure to drill a well along the bottom line, or the south line of that section?

A Yes, sir, I have estimated that a waterflood conducted in that pattern that is served by producing Well No. 26, would recover 92,000 barrels of oil less if it were left open on the south, than it would if an injection well were situated and used 560 feet south of Well No. 26.

Q Now, are those calculations that you have just referred to reflected on what has been marked as Exhibit 5 in Case 4367?

A Yes, sir, those calculations are. I might point out that I believe the figures set forth in --

Q Exhibit 4?

A -- Exhibit 4, are conservative for two reasons. From the standpoint of the amount of oil that would be unrecovered, I mean.

Q This is Exhibit 5 you are referring to now. I thought you were referring to Exhibit 4 which is a tabulation of --

A This hasn't been marked -- I beg your pardon, it has been marked. I think those figures are conservative for two reasons. In the first place, I note that the primary oil,

that volumes that I used for the wells run at the pattern in forming an estimate of primary and secondary ultimate are lower than the figures reported in the Engineering Committee Report. Those figures are lower by several thousand barrels per well and I don't understand exactly how that happened. I know that I asked for those reports to be gathered for me and I used them in my calculations. I did not notice until a moment ago that the primary oil figures don't agree. The figures that I used for estimating reserves are a little lower.

For example, for Well No. 15 in the Exhibit 5, is indicated to have a 1170 cumulative, 367 barrels. I see the reports available set forth in Exhibit 4 shows the well to have 392,000 barrels of recovery at that point so at the outset I used a primary oil which was smaller than is probably the case, as a basis for estimating, for estimating secondary oil which it estimated to be half primary ultimate for closed pattern. I also estimated that an open pattern would recover only half the oil that would be recovered from a closed pattern and that is the basis on which I arrived at the 92,000 barrels incremental oil because injection would not continue after the producing wells in the pattern are watered out. It would be my opinion that at least 92,000 barrels of oil that would not be recovered which Well No. 26 would not be

recovered but Well No. 26, would not be recovered by any well, because I don't believe that it would continue to migrate south toward the Continental lease without some energy pushing it down and with injection halted, I don't believe there is anything left to push it down.

Q Now, would the effect of the increase in the primary recovery figures as indicated on Exhibit 3 result in a revision upwards of your estimate of oil that would be lost if the pattern was not closed?

A Yes, sir, if I recalculate it, using the figures that are in the New Mexico Engineering Committee's report for production from those wells, I would have arrived at a higher figure. I might say that the calculation is only made for the purpose of illustrating an order of magnitude of incremental oil and is not intended to be finite. I actually expect that, although I haven't formed an opinion as to how much it would be, that the incremental oil would be quite a lot greater than 92,000 barrels of oil. But I am certain that it would be that much.

Q That would be lost to the Bridges lease?

A Yes, sir.

MR. SPERLING: I want to offer Exhibits 4 and 5 in Case 4367.

MR. NUTTER: What is 5?

MR. SPERLING: Five is his tabulation.

MR. NUTTER: Mobil's Exhibits 4 and 5 will be admitted
in Case 4367.

(Whereupon, Mobil's Exhibits 4 and
5 offered and admitted in evidence
in Case 4367.)

MR. HATCH: Jason, do you want to see those?

MR. KELLAHIN: Yes.

MR. SPERLING: That is all we have on redirect.

RE-CROSS EXAMINATION

BY MR. KELLAHIN:

Q I don't quite understand your testimony in regard to
the open pattern, are you talking about omitting only the one
well a hundred feet from the Continental lease line?

A Yes, sir, not closing the pattern out by injecting
in the south end of it.

Q The other injectors you are thinking of?

A I don't know what you are talking about.

Q The south side of your lease, the other injector
wells you propose to be injected or to be proposed?

A Yes, I envisioned that injection in my estimate
injection would take place to the north, east and west.

MR. NUTTER: In all but the unorthodox location?

THE WITNESS: That's correct.

Q (By Mr. Kellahin) You are talking about 92,000 barrels of oil coming from that area between Well No. 26 and your proposed injection well?

A No, sir, I am talking about some of it coming from there. The Exhibit shows to what extent I think that it will come from the north half of that pattern and to what extent I think it will come from the south half.

Q You are talking about water coming from the north half of that pattern? You are not going to lose it by failure to inject a hundred feet from Continental's base line, are you?

A I'm sorry, I don't understand your question.

Q You are talking about oil coming from the north of the Well No. 26, failure to drill the other well wouldn't affect that, would it?

A It sure will.

Q You have injection backing up in the Well No. 13 -- I can't read your numbers, looks like --

MR. NUTTER: The one to the west is 29, Mr. Kellahin, and to the east is 15.

Q (By Mr. Kellahin) -- 15 and 29, would protect any drainage in that direction?

A No, sir, you'd have a situation where you are pushing

three sides and not pushing on the fourth and that's going to be an area of low pressure where the fluids will move pretty readily in my opinion.

Q Are you saying then, that oil being pushed in from the north will by-pass your Well 26?

A Yes, sir, unless the pattern is closed on the south side that my estimate is half the oil that is moved from the direction of 26 from the north will by-pass it and be lost to the south side of that pattern.

Q Would that not depend on your injection rate to a considerable degree?

A I suppose it's within the realm of possibility that some injection rate configuration could be developed which would control the amount of oil that would be forced to migrate out, yes, sir. I don't think it would be within reasonable limits, I think we are talking about a few barrels a day.

Q Actually, you are just guessing, aren't you? Aren't we both just guessing as to what might by-pass that well?

A Well, I've concerned myself with studying a lot of waterfloods and that's my business.

Q How much water are you going to put in those wells? What rate?

A That's my opinion from the experience that I have had.

I haven't designed individual well injection rates for those at the present time because I haven't analyzed my reservoir volumes as yet. I am having isopak maps prepared of the porosities in this area and I will base the individual well injection rates on those reservoir volumes.

Q Well, now, your Exhibit No. 5 here, which gives an estimate on the amount of oil that will be lost, is that based entirely on prior production as a basis for your reserves? How do you arrive at these reserves that you say are going to be lost?

A I have just made the assumption that waterflood oil in a closed pattern would equal half of primary, which is an order of magnitude thing itself. The fact is I believe we have seen performance to the north at present which would support a greater recovery than that. I have made the assumption we could do as well on the closed pattern on the south end of the lease as we are doing on the north end of the lease and that a secondary to primary of half is a reasonable rule of thumb to use in estimating what I would classify as a minimum reserve. I believe it would be at least that much.

Q You haven't made a study to determine the reserves that are there, have you?

A I am not sure I follow your question completely.

I study this reservoir all the time and I have formed some opinions about the reserves, yes, sir.

Q What factors do you take into consideration in forming that opinion?

A Well, performance.

Q Did you go into calculations, into reservoir capacity?

A Well, we don't know very much about reservoir capacity. The thing we do know is if the reports have been filed accurately is how much oil came out of the wells and that's the most sure thing that we have. As I said earlier, most of these wells were drilled in the 1930's and they were not logged.

Q You have no core area?

A The wells which were drilled on the extreme north end of the Bridges lease are fairly recent completions, within the last ten, fifteen years and a good many of those were logged and we did cut some cores in the extreme north end.

Q But you have no such reservoir --

A I have no such data on the central or south part. We do have a core, as I recall, on San Andres Well No. 27 in Section 26. I think that's the only well that was cored in the extreme north end.

Q You say according to your estimate, 92,000 barrels

will be lost. Do you mean lost, or would the recovery of that be postponed until additional flooding were done?

A Well, I assume that a system could be devised that would later be recovered. I question whether it would be an economical thing to do it. It's conceivable that after the producing well in that pattern is watered out, that we could leave the lease under an abandoned condition for some years or temporary abandoned condition and come back and get it. I doubt that we would want to leave the hardware sitting there. It would require some investment to get it back in the future. I doubt that it would economically recoverable. I think it would be lost.

Q What remaining life do you feel there is in this secondary recovery project which you are going to initiate in the south end? How long will it go on?

A I haven't the data at hand to tell you exactly how long I have projected it to continue, but off-hand, I could say that I recall it's in the order of 15 years.

Q Mr. Kelly, actually, waterflood was started as a project, pilot project, in 1958?

A Yes, sir.

Q And it's gone by stages progressively, towards the south and there is an extension to the north as I understand it?

A Well, there's going to be one.

Q But it has been a progressive flood, has it not?

A Yes, sir, we have expanded the flood already through the main body of the Bridges State lease with the exception of the two sections that are remaining on the south end of the lease and the six additional injection wells that will be placed on injection in cooperation with the Yates Unit and the Gulf Lease, State "FE", lease.

Q That is over a period of 12 years you have had a progressive flood through this area?

A Yes, sir, progressive, that is, we expanded the last time in 1967. This is a little less than three years later we are planning to go --

Q You estimate about fifteen more years on the southern portion during that period? Isn't it conceivable that it would be expanded to the south as depletion occurs, or do you think that the operators are going to leave the oil in the grounds?

A I don't know when it might be expanded on to the south. I mean, that's farther south of the Bridges State lease. I haven't studied that reservoir down there well enough to have an opinion whether it will ever need waterflood, really. I don't know for sure whether you've got a good water drive

affecting that or not. I know there is a marked difference in the characteristic of production which seems to coincide with the south line of the Bridges lease in there, as the reports have been filed with the authorities.

MR. KELLAHIN: Thank you, Mr. Kelly.

MR. NUTTER: Any other questions of Mr. Kelly?

You may be excused.

(Whereupon, the witness was excused.)

MR. NUTTER: Anything further, Mr. Sperling?

MR. SPERLING: Not at this time.

* * * * *

PAUL ZEMAN

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

DIRECT EXAMINATION

BY MR. LOPEZ:

Q Would you please state your name, address and occupation?

A I am Paul Zeman. I live in Midland, Texas. I work for Marathon Oil Company at the present. At the present time I am District Reservoir Engineering Supervisor.

MR. NUTTER: How do you spell your last name?

THE WITNESS: Z-e-m-a-n.

Q (By Mr. Lopez) Have you ever before testified before

this Commission?

A No, I have not.

Q Would you give the Commission a little run-down on your educational background?

A Yes, sir. In 1953, I graduated with a Bachelor of Science in Petroleum Science from Marietta College, Ohio. During that summer I was employed with Buckeye Pipeline in Ohio before going to the University of Oklahoma to do graduate work. In 1954, I was employed by Marathon Oil Company and was sent to Hobbs, New Mexico, on a training program.

I stayed for a year working in the field, and after the year, 1955, I was transferred to Midland, Texas, as a Reservoir Engineer. I have been in Midland, Texas, since 1955, and have advanced to my present position as Reservoir Engineering Supervisor, which I have held for the past three years.

Q In your position as Engineering Supervisor, what District does that include?

A All the Permian Basin in Texas and New Mexico. I am registered in the State of Texas and Oklahoma.

MR. LOPEZ: Are his qualifications acceptable?

MR. NUTTER: Yes, they are. Please proceed.

Q (By Mr. Lopez) Mr. Zeman, have you prepared some exhibits in connection with the problem being discussed today?

A Yes, I have.

(Whereupon, Marathon's Exhibits 1 through 8 marked for identification)

Q (By Mr. Lopez) I hand you what has been marked as Marathon's Exhibit No. 1. Would you please identify this exhibit, Mr. Zeman?

A This Exhibit No. 1 is a portion of the Vacuum Field. It includes the area under discussion for this hearing, this case. The green line, which you notice borders here, encompasses Mobil's State Bridges lease as defined in their Order 1244 that they had on September 17, 1958. That same Order, they initiated a six-well injection pilot waterflood in Section 14, and these wells are colored in red.

From 1963 to 1967, they expanded this waterflood by converting fourteen ~~more~~ injection wells, wells to injection. These are colored in orange and I believe they were done by administrative approval because I couldn't find anything in the orders.

In 1967, they had Order R-3318 remanding Order 3244 on September 12, 1967, where they proposed to convert ten wells to injection. These wells are colored in purple. One of these wells, No. 52A of Section 27 in Township 17 South, Range 34 East, they originally wanted to convert in '67 and didn't do it and they are re-submitting that at this present hearing.

In 1967, they requested that 127 be converted to an injection well and the present case, the expansion to the south, includes the ones that are circled, that aren't filled in, and there is one well to be drilled, new well to be drilled in "N" 26, 17, 34, and drilled for injection, and one well to be drilled in "E" 25, 17, 34, and proposed to convert 13 other wells and these are all circled in brown there.

Q Now, Mr. Zeman --

A Our acreage is colored in yellow.

Q -- now at this point, I would like to go into the history of your production in your acreage. We might as well submit some more exhibits at this time. I hand you Exhibit No. 2.

A Now part of Mobil's current expansion will be adjacent to our State of New Mexico McAllister lease. They plan to drill an injection to offset our No. 4 to the north and converting Well No. 25 to injection on the west side. Now all these -- I don't have any deep wells on this map, they are all San Andres and all wells that have produced San Andres, possibly been drilled deeper. All of these wells have produced San Andres oil.

We are the operators in the State of New Mexico McAllister Reservoir, four single completed San Andres wells and the Exhibit that Owen has just given you shows an individual

oil basis, a cumulative oil production as of May 1, 1970, the April production, 1970, and the latest production tests. These wells were completed, drilled and completed, in 1938 and 1939 and you notice the No. 1 well is still flowing. The others, No. 3 and No. 4 are still top allowable wells. No. 2 is still making quite a bit of oil and some water.

Q At this time, we had better introduce Exhibit No. 3. Rather, not introducing -- I believe this is connected with the other?

A Basically, with the second exhibit. What I have shown here from 1959 on is the annual production for individual wells in our State McAllister lease and also on the top scale there the annual water production. I'd like to go over these exhibits with you.

No. 1, you can see the production has gone up from approximately 7500 barrels a year to roughly 27,000, absolutely no water introduced in this well at all since it was drilled.

No. 2 is producing approximately 12,000 barrels a year and we have begun to produce water in 1965, slight amount of water, and our major water got kicked up in '68 and '69 when we deepened all of our wells and I will get into that a little later on.

Here again in Well No. 3 we have established a

terrific kick in 1968 to '69 and our production is substantially high of 27,000 barrels a year, no water.

In No. 4, producing quite a bit of oil, 13,000, gone up as high as 19,000 barrels roughly.

Q Mr. Zeman, do you have any opinion as to why the production in these wells has been so successful, or apparently successful?

A These wells, I say, were drilled in 1938 and 1939 and were completed on that open hole, it was common practice in those days, and I'd like to discuss some of the procedures we have got to use to keep our production, maintain our production, up.

Q This is Exhibit No. 4 -- this one, I'm sorry, they are not all colored, but that one is.

A What we have here, as you know, is in 1960 we found some deeper pay in the Vacuum field. The original wells in the Vacuum field were not logged, geologist sample logs, things of that nature. I have taken our deep Blinberry-Glorieta duals, they are twin wells, to our Vacuum wells that were drilled in '60. We have not been able to use good logs. I have plotted a cross-section here. The data is zero sub-sea basis and I have the top of the San Andres shown and have the top of the Lovington and base of the Lovington shown and the Lovington is a minus

750 feet. Now, I have superimposed, since they are twin wells here, and elevation is basically flat in the Vacuum area, I have superimposed our Grayberg wells on the logs of these deeper tests and there is not much variation between the tops. For example, if you take the first one, No. 10 well, by using No. 10 and superimposing No. 1, the top of the San Andres in No. 10 is minus 324 and the top of No. 1 is minus 332.

In other words, 1 is only eight foot low to No. 10. If you go over here in Well No. 8, difference is only three feet so we are basically, practically, even with these twin wells. With these new logs, I would be able to evaluate the formation under our State of New Mexico-McAllister lease and I have also tried to show here what we have done in our work-over program.

As you noticed -- let's take the one, No. 10, it's Well No. 1, when this Well No. 1 was drilled, we set seven-inch casing at 4083 on the bottom of the hole and the initial total depth is 4,680 feet. That was a considerable distance in open hole interval there. In 1959, we drilled a well to a new total depth of 4705. We drilled 25 feet deeper and I hope you can see that on the cross-section. We ran a four-and-a-half-inch liner, we couldn't get it to the bottom, and we have the interval shown in green there, open to production at the present time.

I'd like to make some other statement on this

Well No. 1. Prior to running this liner and when this open hole section was open, the well was put on pump in 1947. Prior to doing the work-over on the liner, our No. 1 well was down to pumping 14 barrels of oil per day. After we ran the liner and treated the form, open hole section, you see there we re-potentialled the well flowing 69 barrels of oil and no water in six hours, or for a rate of 270 barrels of oil per day on a half-inch choke.

MR. NUTTER: When was this?

THE WITNESS: 1959.

MR. NUTTER: That explains the first jump in production?

THE WITNESS: That's right, and that's normal unit allowable in that, too.

Q (By Mr. Lopez) What is the advantage of running the liner, in your estimation?

A When you run a liner here, I can control your reservoir. We have more options of what we can do. We can selectively test each interval. We can treat and know basically that our treatment is going into a certain interval and what we are trying to do here, we are trying to establish an orderly method of depleting our reservoir. We will go up the hole as these things get depleted. Since 1959, we have run liners in

all our wells and, as you can see from our production curves, our lease is a pretty good lease. Maybe we can go back to this cross-section a little later on.

Q I hand you what is marked as Marathon's Exhibit No. 4, I believe, --

MR. HATCH: Five.

Q (By Mr. Lopez) -- and would ask you to identify it.

A Exhibit No. 4?

MR. NUTTER: This is Exhibit No. 5.

MR. LOPEZ: All right, I was mistaken.

A Exhibit No. 5 is a cross-section A-A Prime, that goes from the north to the south. It starts in Mobil's Bridges 58, goes through their 36, goes through their 13 and all of the line goes through our deep test six for a better quality log.

As is shown on this small cross-section, I have hung this, or used the datum here on top of the San Andres which is not quite the same as I had on this first cross-section and you can correlate the top of the Lovington Sand, the top of the Lovington Sand and what I call correlation point one and point two. As previously stated by Mobil, there is two separate upper San Andres and the lower San Andres and this is pretty common in the area and this Lovington Sand is common correlation

point.

I want to use this exhibit to show continuity of these zones from the north to the south and going over, say, from our No. 6, you can see the upper part that has porosity. These are sonic logs and sonic logs on the right-hand side, the Gamma Ray Neutron and a Gamma Ray log on the left-hand side. You come over to Mobil's No. 13, this is a well that used to produce from San Andres and moved it to Blineberry, still a Blineberry and producing 560 barrels a month. When they produced this well from the San Andres they shot this upper section of San Andres with 320 quarts of nitro. If you look at their log, the upper part of the San Andres, you will see besides the Gamma Ray, you will see a calipre log with a whole size of approximately, I'd say, 20 inches and again, if you go up to 36, I'm sure they shot that well with nitro because you see the calipre sticking up there.

Now, with these being sonic logs you cannot use that part of the log for any evaluation of the porosity because you've got a lot of cycle skipping and it is pretty well fractured up. You can see parts of the porosity going across there and going down to the lower porosity interval, correlation points one and two. You can basically correlate from our six across going north, although some of the porosity is getting kind of

erratic. There is some correlation there.

Q Have you made another correlation?

A Yes, I have.

Q I hand you Marathon's Exhibit No. 6 and ask you if you would identify that.

A This Exhibit No. 6 is Cross-Section E-B. It goes from Bridges State No. 27 through their old San Andres well, still producing, No. 25, through their No. 99 well which is a deep test for quality log and back into our No. 6. Again, I have used the datum of the top of the San Andres, top of the Lovington Sands, base of the Lovington Sands, and same correlation point, one and two, for lower porosity.

The No. 27 was drilled deeper and was a discovery well in the Vacuum-Blaineberry Field well. Mobil discovered the deeper pay.

No. 25 is a San Andres well, still producing. This was a Gamma Ray Neutron Log which was run quite a while back and I have tried to show with their 99 an interval stops up there. We didn't have a large-scale log that didn't run a detailed log above this 99. There is a definite correlation between the 25 and 99, there should be because they are twin wells.

On 25, it doesn't go deep enough to pick up the

lower porosity. Going over to the right-hand side, to our No. 6, you see this massive porosity interval in the lower San Andres. We correlate that to 99. It looks about the same. So Mobil should drill their 25 deeper and make an oil well.

Q Does your study, especially reflected in these two last exhibits, show that there is a similarity in formation between the Marathon section and that where Mobil proposes to extend its flood project?

A Pardon, now?

Q Does your study, especially reflected by these two last exhibits, indicate that there is a similarity in formation between the Marathon section --

A There is a continuity across. I was trying to get one coming from the north and one coming from the west. That is the difference between the A-A and the B Prime and --

Q Mr. Zeman, I would like to ask you if you have done any studies on the pilot injection wells and the other wells, water injection wells.

A Yes, I have.

Q Done by Mobil toward the north?

A I have. I would like to say now Mobil plans to drill this well, this north offset down to 4700 feet which would pick up both the upper and lower San Andres. Now we have the upper

case. We're working on the lower part now. At some future date we hope to go up there and stimulate this. We have new techniques, selectively perforate, and I think we can do some good. Now I don't know what they plan on doing with 25. I think they plan drilling deeper and open hole, that is my understanding, deeper to pick up this lower porosity and complete an open hole.

MR. NUTTER: Mr. Zeman, when Mr. McAdam was discussing with Mr. Kelly, during his direct testimony and cross examination, what he was referring to was the lower porosity, mentions the lower porosity.

THE WITNESS: That's right.

MR. NUTTER: What did you finally decide he was talking about?

THE WITNESS: My interpretation --

MR. NUTTER: The area point between correlation points one and two on your exhibit?

THE WITNESS: That's right.

MR. NUTTER: So that is the lower porosity he is talking about here and that they are flooding and these are between 1 and 2 on yours?

THE WITNESS: That's right. They are going to drill 25 deeper to get to that point.

MR. NUTTER: That 25 doesn't reach that deep?

THE WITNESS: That's my understanding of that log.

Now, they propose to put water into this well that they are going to drill and convert this 25, No. 25, to an injection well and one of the problems I envision that when they start putting water in there, it's going to start pushing water on our acreage and a good possibility, in my opinion, that could be water put on our acreage.

Q (By Mr. Lopez) You have done studies, Mr. Zeman, of the water injections from Mobil towards the north and I think at this time it would be good to introduce those. I hand you Marathon's Exhibits No. 7 and No. 8 and ask you to identify them.

A We are producing oil down here, top allowable, it would be definitely our position now that we cannot convert any wells to the injection to cooperate with Mobil. We have been asked and this is our reason for top allowable wells. I think that's pretty apparent. Now, if they drill this well and convert this 25, I believe they are going to put water in the lower porosity and we won't have the advantage of producing the upper porosity because it's behind pipe right now and the Commission doesn't recognize the upper and lower as separate reservoirs.

Since two are on top allowable, we wouldn't get any benefit at the present time. There is a good possibility while we are producing the lower zone and they are flooding the upper zone when our time comes to go up and perforate we'll be full of water. The oil will have migrated past our wells.

Q Do you have any knowledge of how long you project your wells to be producing as they are now?

A I think two or three of our wells, two or three at the present interval for top allowable, at least three years and assuming normal decline of 15%, another ten to twelve years on that with the option to go and do a liner program.

Now, if they start putting water, one of the things that can intrigue me is how fast will this water move in here from the injection well into our lease. I really don't know so I thought -- well, they've had some experience in their State Bridges flood to the north and I have tried in these two last exhibits to observe the performance of some of their selected wells to the north and they include some of the pilot area and some of the additions coming to the south.

Q These wells you have selected, is it a basic cross-section of their area, will it give you a fair indication of what results will be, in your opinion?

A Yes, sir, in my opinion. I have 13 producing wells

in one booklet here, not labeled, and fourteen injection wells. Now you notice on your copy that I have made a correction on the injection wells and I would like to get into that. There is a typographical error and if you look at the scale on the left-hand side, annual water injected barrels, that should be raised to another tenth power. In other words, instead of 10,000, it should be 100,000, and instead of 50,000 it should be 500,000. I have tried to do that with a pencil and initial each sheet, a typographical error, for injection wells.

You go back to the producers now -- let's look at the first one, for example. This is Well No. 8 and is a producing well located in "J", 23, 17, 34, if you can find that.

Q If you go back to Exhibit No. 1, you will find where the wells are located?

A If you look at this first.

MR. SPERLING: I was trying to see, in "J", where?

THE WITNESS: "J", 23, 17, 34, and it is a new well, not one of the old pilots. If you look there from '59 to '67, '68, our normal decline, stripper stage, and they did get a kick in '69 although they made approximately 7,000 barrels of oil. It had a break-through the same year, making about 15,000 barrels of water.

Let's go to No. 10, "F" 23,17; that is still in Section 23 there, yes. It's the northwest well to No. 8. You can see here that they got an initial break-through in 1963 and they're kicking production on the bottom curve there is not too nominal until they start putting more water in the ground, and will have to go to injection wells to see this and when they did get a kick from oil, around 8,000 to 13,000 barrels a year, their water break-through and production, you can see it's off the scale. And here is one in Well No. 23 and "L" 24, 17, 34. That is in the section to the east. Now that well is surrounded by relatively new injection wells and although they get a kick, immediate response, they also get an immediate response to water, too.

I have tried to do this, I don't think it is important enough to go through each well, but you can thumb through here, some wells are all right and some wells have had quite a bit of break-through.

Take for example now, Well No. 67 in "L" 14, 17, 34, that well is an offset to the original pilot and you can see that he didn't get too much of a response, production-wise annually. The best they could do for '59 to '63 was about 5500 barrels a year and then they must have kicked up the water injection because they got an increase in oil, but

immediate break-through of water. You can see the rate's up annually.

I would like to go to these injection wells and in here, this curve, with out injections, the curve on the left reflects the annual water injected and the curve on the top of the scale on the right shows the injection pressure and, take the first one for example, No. 2, this is the south well in the original pilot. They got most of their water high, from 350,000 barrels when they have gotten pressure of about 2300 pounds.

Now, if we can look at Well 55 to the south, on this other curve, from a producing well, let's just get a correlation here. Go back to the producing wells -- 55 -- in '67, on injection No. 2 well, they put in approximately 355,000 barrels of water and that same year, '64, they produced --

MR. NUTTER: In '64, not '67?

THE WITNESS: We are looking --

MR. NUTTER: You're on injection well No. 2?

THE WITNESS: That's right, in Well -- the south offset from 55.

MR. NUTTER: Right.

Q (By Mr. Lopez) In the year '64, you're right.

A As I say again, they put 355,000 barrels of water and their highest rate in 1964 in the south offset immediately

in '64, produced approximately 50,000 barrels that year while only making roughly 7,000 barrels of oil, so your water cut is pretty darn high.

You can go through these and see this trend. What I am saying, when they have injection water, they have a break-through within a year or two. That's pretty fast.

Q Mr. Zeman, if their application to drill their proposed injection well, which is an offset to Marathon's Well No. 4, and their conversion of Well No. 25 which also appears to be an offset to Marathon's Well No. 4, is it your opinion that if they do their, their application is granted in these instances, there would be initial break-through of water into your area which would substantially harm your interest?

A In my opinion, based on what I see of the flood to the north, there is a good possibility we would have premature break-through, possibly killing our flowing well, possibly putting water into our pumping well, which would reduce our capacity.

In addition, some of the zones not open now because they are behind our lines but at a later date when we try to recomplete there, they probably would be full of water.

Q Now, as you recall, Mr. Kelly on Redirect, discussed reservoirs which he estimated to exist in Mobil's Section 26 in

the south part between Marathon's Wells 29, 35, 15 and 26. Have you made any studies and can you estimate the reservoirs that exists in your area of operation?

A In relation to the reservoirs under our acreage, if I may refer you back to that small cross-section of the colored line, tried to color it up, in addition to showing the pay here I have done a little qualitative work on attempting to find the reserves under our acreage. As you note, there is some colored red coloring in the Upper San Andres and in the Lower. They also show some porosity scale. I have used a cutoff porosity of 3% all the way up, coloring stops at 3%, the porosity scale goes up to 20.

You can kind of get a relative idea of what porosity looks like and if you look on the Gamma Ray side you will notice the lower section and the upper, the section is relatively clean. I have estimated that the in-place oil under our acreage is 9.7 million barrels. We, Marathon, have produced approximately 1.8 million barrels to date on these four wells for a recovery factor of 18.4%.

If it is a solution-type gas reserve, we have produced 18%. That's pretty good for a solution gas reservoir. It's obviously, with our top allowable, we are going to produce a lot more than 18%.

MR. NUTTER: You had 9.3 million original oil on flood?

THE WITNESS: 9.7 million.

MR. NUTTER: And you have produced to date 1.8?

THE WITNESS: 1.8, roughly 1.79, as of the first of the year and our leases are still pretty good. I estimated that this, I think, can be a conservative estimate, a recovery of 25% since we have produced 15%, this might be a conservative estimate because we might have gravity drainage and other mechanism that will benefit us. If this is the case, this is 640,000 barrels of primary reserve left under our lease and if at some distant date we assume that this production will have to go down from where it is right now, from the zones it is producing from right now, at a rate of 15% out of the 638,000 barrels, approximately 465,000 barrels will be produced during the declining period. Therefore, we'd have 174,000 produced on a current rate. We still have top allowable of about 3 years.

Q (By Mr. Lopez) Now, I will direct your attention to another question. Is it your opinion that there is a substantial possibility if Mobil's application to extend its waterflood project is permitted, since you do not have a back-up to your quarter section, that there will be a substantial amount of oil irretrievably lost?

A Yes, sir, it is my opinion.

Q Is there any way there could be a further expansion of this waterflood project to the south at this time?

A We can't do anything on our lease. We have got 15 years primary production, 600,000 barrels before we think of a secondary.

Q And therefore, you could not agree to the proposed cooperation with Mobil because you are not even close --

A We are not ready for flood. I think the evidence shown here shows the quality of our acreage.

MR. LOPEZ: I have no further questions.

MR. NUTTER: Any questions of Mr. Zeman?

MR. LOPEZ: I forgot to offer my exhibits into evidence.

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

(Whereupon, Marathon's Exhibits
1 through 8 offered and admitted
in evidence.)

CROSS EXAMINATION

BY MR. SPERLING:

Q Do you have any measured bottom hole pressures in your wells?

A Yes, sir. The No. 1 well last year, the Commission took a bottom hole pressure and it was seven hundred and some

pounds, I think 751 - do you have that list - a little over seven hundred pounds.

Q That's the only well where you had a break made?

A There is only seven wells taking pressure in the Vacuum Field and these, I'm sure, are flowing wells to the south because to take a bottom hole pressure on these pumping wells would be pretty expensive, you'd have to just pull your rods and pump. Every year they have cut the number of bottom hole pressures they have taken.

Q Mr. Zeman, if you feel as you apparently do, that the continuity of the San Andres is as you have explained it here, why is it that Mobil's wells aren't as good as yours?

A No. 13 was a San Andres well and I don't know what the cumulative production is on that. They shot that well in the upper section, thereby limiting what they could do to that well, and if you can run a liner in there, but there is a pretty good sized hole in there and while that well was shut in and we went during that time, increment period, ran a liner and selectively perforated and treated these wells and maintained our production.

Q Well, do I understand that none of the four Marathon wells were open hole completions?

A They were originally all open hole completions. The No. 1 well, with production down to 19 barrels a day before we

ran the liner. All our wells before we ran liners, production decreased to 20 barrels a day and we figured we could increase production by running a liner and selectively treating because on original completions they gave it a little acid.

Q Were any of the four Marathon wells completed naturally initially, that is, without treatment of any kind, shooting?

A Our No. 1 Well flowed naturally 51 barrels an hour.

Q Was that well subsequently shot?

A No, our holes were in good condition before we ran a liner, otherwise, if we shot them we couldn't run a liner.

Q Well, that suggests to me that at least the conclusion of extreme negligence on Mobil's part in shooting wells in the first place, is that your conclusion?

MR. LOPEZ: That is a legal conclusion, I believe.

MR. SPERLING: No, it isn't, it's an engineering conclusion.

THE WITNESS: It is my opinion that they ruined their wells; not all of them. I am looking at some of the calipre logs.

Q Now, do you think that if Mobil had a 51 barrel well naturally that they would have shot it?

A No, sir, they shot theirs and their well came in flowing 320 barrels a day, one of them. It's on the cross-section.

Q Do you have available any decline curves on your wells?

A No, sir, our lease is going straight across.

Q Which well was it that flowed three hundred some barrels initially?

A Let's look at some wells in these cross-sections, if somebody is interested. Let's look at cross-section A-A Prime. Their well No. 36 up there in "D", that well was completed 7-9-59 and it flowed natural 376 barrels of oil per day.

Let's take a look at another one, No. 13 here, offsetting off to the north, cross-section A, that's the one that they used 320 quarts of nitro. They used 5,000 gallons of acid, too, and they placed their nitro opposite 4390 to 4550 and the test shown here is 110 barrels per day in 24 hours.

Now, we can go over to this cross-section B-B Prime. Let's stay on cross-section A-A and we'll get that '58 well there. That's a Glorieta test. That was drilled deeper to the Glorieta test. The original completion in 4-1-40, they shot that with 380 quarts from about 4478 to 4600, I don't know if that's shown up on the calipre log there. They had initial potential flow of 288 barrels per day, initial flow.

I will go to cross-section B-B, No. 27, which is the discovery well in the Blineberry, was originally a San Andres

well, and that was completed in 4-27-39 and that was shot with 240 quarts from 4430 to 4450 and flowed 464 and Mobil's No. 25 which is in Section 26 there, on the cross-section, it had a natural flow of 140 barrels per day. That well was completed in 2-26-39. It's not a No. 99, that's a deep test. That's it, basically, Mobil's wells on these two cross-sections.

MR. SPERLING: That's all I have, Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Zeman, what is Marathon's position. They're opposed to any flooding by Mobil in this area, or what?

A No, I don't believe that is the case. We would, and I think Continental will concur with us, that we are not opposed to Mobil waterflooding. We would like to, due to our lease, quality of our lease, to possibly put in a buffer zone of one row of wells, keep your injection wells one row up.

Q It's obvious you are not ready for flooding, if you want to call waterflooding a secondary recovery --

A That's right.

Q -- and by the Commission's definition, you certainly wouldn't qualify.

A We couldn't convert waterflooding.

Q That would refer to maintenance but not waterflooding?

A That's right.

Q What you are thinking of is at least one row of producing wells without any injection wells. Do you think that injection wells that were maintained at a minimum of two locations away would have any detrimental effect on production from your lease?

A It would give us a little more time to produce our wells, I think. The likelihood of us watering out would be minimized.

Q Do you know what the status of Texaco "Q" lease is, to the east of you?

A The "Q" lease. "Q" lease, Well No. 1, and I am referring to the March production figures, Well No. 1 pumped 73 barrels of oil per day, 7.6 barrels of water per day for a water cut of 9.4. Their "Q" No. 2 pumped 73 barrels of oil, 7.6 barrels of water per day for 9.4 water cut.

Q Those are the exact same figures?

A I think they just proportioned it out.

Q What is No. 3?

A They pumped 24.3 barrels a day and no water.

Q And these tests that you gave us on your Exhibit No. 2 are the latest tests that you have run?

A That's right, yes, the latest tests --

Q One made 37, the other one made 38, No. 3 made 81 and No. 4 made 68.

MR. NUTTER: Are there any other questions of Mr. Zeman? You may be excused.

(Whereupon, the witness was excused.)

MR. NUTTER: Do you have anything else, Mr. Lopez?

MR. LOPEZ: No, I don't. I would like to make a brief statement at the end if I deem it necessary.

MR. NUTTER: Mr. Kellahin, were you going to present any testimony?

MR. KELLAHIN: A short witness.

* * * * *

VICTOR LYON

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A Victor T. Lyon.

Q By whom are you employed and what position, Mr. Lyon?

A Continental Oil Company Conservation Coordinator in Hobbs Division Office.

Q Have you testified before the Oil Commission, and made your qualifications as an engineer a matter of record?

A Yes, I have.

MR. KELLAHIN: Are the witness's qualifications acceptable?

MR. NUTTER: Yes, they are.

Q (By Mr. Kellahin) Are you familiar with the application presently before the Commission, and have you heard the testimony that has been presented up to the present time in this Case?

A Yes, sir.

Q In connection with this application, is Continental Oil Company an offset operator to the proposed expansion of this waterflood, and if so, where?

A We are an offset operator to the proposed expansion as our State H 35 lease adjoins the Bridges State lease to the south. Our lease consists of the northeast quarter and the east half of the northwest quarter of Section 35 in the same area.

Q 17 South, Range 34 East?

A Right.

Q Would you discuss briefly the situation as to your producing wells, what their production is and what their present

situation is?

A Yes, sir, we have six wells which are completed in the Grayberg San Andres on our State H 35 lease, No. 1 which is located in Unit "I", last test of this was in February, 25 barrels of oil, 4 barrels of water per day.

No. 2, which is located in Unit "A", tested 60 barrels of oil, no water per day.

No. 3, which is in Unit "B", tested 31 barrels of oil, no water.

Well No. 4, which is in Unit "F" is shut in. Its last test was in December of '69 when it produced no oil, 15 barrels of water.

Well No. 5 in Unit "G", last tested 27 barrels of oil, no water.

Well No. 6 in Unit "C" tested 12 barrels of oil, 2 barrels of water.

I believe that this is average, of 26 barrels of oil, one barrel of water per day per well.

Q Would you consider this lease at an advanced stage of depletion?

A No, I wouldn't.

Q Would you consider it ready at this point, as a reservoir engineer, would you consider this lease ready for waterflooding?

A No, not only from the basis of its current production, but because of some remedial possibilities which we feel exist on our lease.

Q Now, in connection with the remedial possibilities, would you state to the Commission what you do propose to do with these wells?

A We have recently given some studies to the work that Marathon did on State-McAllister lease and believe we have very good possibilities of developing the same zone on our lease which, if anywhere near as successful as Marathon's program, should bring our wells up to or close to top allowable production.

Q Would you propose to form a similar recompletion by running a liner as Marathon did or some similar operation?

A Our initial evaluation test is proposed to be performed in Well No. 10 which is a twin well to 5. This is a slant-holed dual completion in the Glorieta and Blinberry. The Blinberry is not commercially productive. We propose to plug off the perforations in that well and use the casing to perforate and evaluate the lower zone in that well.

Q Now, how are your other wells completed in the Grayburg and San Andres?

A They have large open hole sections.

Q Were any of them stimulated by shooting or exercising?

A Well, there were none shot. One well was treated with 5,000 gallons of acid, that was No. 4, and my information indicates the others were not stimulated, not on initial completion.

Q In your opinion, would those wells lend themselves to recompletion as was done by Marathon?

A Yes, I think very definitely.

Q Now, you heard Mr. Kelly testify as to Mobil's offer to enter into a land agreement, did you not?

A Yes, sir.

Q Did Continental refuse to enter into that agreement?

A Yes, we did.

Q Are you familiar with that?

A Somewhat.

Q For what reason did Continental decline to enter into the agreement?

A There are two reasons. In the first place, they asked that we convert our No. 2 well into an injection well as our No. 6. No. 2 is a 60 barrel per day well. No. 6 is a 12 barrel per day well and we were a little reluctant to convert a 60 barrel well to injection. There was another reason. In every waterflood where you stop your waterflood pattern short of the

boundaries of the pool, there is a loss of efficiency because all of the producing wells are not completely enclosed by injectors and it's highly desirable, of course, to have all wells, oil wells, backed up. But when all leases are not ready to be stimulated by water injection, these patterns have got to stop somewhere and we are reluctant to place our wells on injection or our lease on injection, without a backup from the other side.

The other side happens to be Phillip's Hale lease and those wells are essentially top allowable and certainly they are not interested in converting any of their wells to injection.

Q Then if Continental were to enter into a land agreement and put their wells on injection, would they find themselves then in the same position Mobil finds itself in now, without a back-up to the south?

A Yes, sir, that is very true.

Q What remedy do you propose for Mobil which would adequately protect Continental in this case?

A In order to give us time to evaluate our reserves by the proposed recompletion project, and to let our wells decline a little bit further, we would like for them to refrain from injecting water in wells which directly offset our lease.

Q That would be No. 29 and No. 15 and the proposed well

on the lease lines, practically on the lease lines, is that correct?

A Yes, sir.

Q In your opinion, and based on the evidence you have heard here today, you feel water would encroach on Continental's lease if this application of Mobil's is approved?

A I think that the likelihood is so great it is a virtual certainty.

Q Would that result in a loss to Continental Oil Company?

A We feel that the encroachment of water into our wells will certainly lift our lifting cost, certainly a possibility that could change fluid saturation to the extent that future waterflooding on our lease would be impaired.

Q Would it move oil past your wells which would not be ultimately recovered by you?

A I don't know.

Q You say it would increase your lifting cost. Do you have any salt water disposal problems in this area?

A We produced very little water. We do have a facility for disposing of produced water but it still represents some expense, not only in lifting, but also in separating and disposal.

Q If water did encroach on Continental's lease that would be an economic loss to Continental, would it not?

A Yes, and I think also that it would certainly place our remaining reserves, to some degree, in jeopardy, the fact that outside water has been introduced into our wells.

Q Now, would you sum up the position of Continental Oil Company in regard to this application?

A I have a statement here which summarizes pretty well our position on this. Unfortunately, it frequently occurs that all properties in a reservoir do not decline in production at a uniform rate. While one operator's property may be essentially depleted another's may still be in a flush or semi-flush stage of production. When this occurs, it becomes necessary for the one operator to institute secondary recovery operations while the other is still operating profitably on primary production. It is recognized that in waterflooding, unbalanced floods where there is no back-up, frequently results in a loss of efficiency and a loss of recoverable reserves.

Continental Oil Company in this instance, finds itself in the position of being unable to cooperate in a waterflood project because one, its production is still at a fairly high rate with one well producing as high as 60 barrels per day, because the offset operator on the opposite side of our lease

has top allowable production and cannot furnish a back-up for our injection pattern.

Furthermore, recent developments indicate the probability that initial reserves are available on our lease by deepening of existing wells or plugging back of wells in deeper horizons. It is our position that the placing on injection of offset wells will create waste and impair our correlative rights in that, one, injected water will probably channel to our wells, increasing the volume of water to be lifted and possibly drowning producing zones and, two, the fluid content on our lease will be distorted such that secondary recovery operations, when conducted on our lease, will be less efficient than they otherwise would be.

Consequently, Continental Oil Company must respectfully request that no injection well be located within less than 1650 feet from our lease line at the present time, and until such time as a cooperative project which will protect the rights of all parties can be initiated.

MR. KELLAHIN: That's all we have, Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Lyon, would you go very quickly through the latest tests which you have on that San Andres well, please?

A No. 1, 25 oil, 4 water per day; No. 2, 60 oil, no water; No. 3, 31 oil, no water; No. 4, shut in; No. 5, 27 oil, no water; No. 6, 12 oil, 2 water.

Q Why is the No. 4 shut in?

A It stopped producing oil.

Q Did it have a pump on it?

A I don't know -- yes, it did have a co-pump installed in 1950.

Q When was it shut in?

A December of '69, was the date on these tests, approximate, about February 24th.

Q This would be in February of 1970?

A Yes, sir.

MR. NUTTER: Any further questions of Mr. Lyon?

MR. SPERLING: I have a couple of questions.

CROSS EXAMINATION

BY MR. SPERLING:

Q Mr. Lyon, do you think that the injection of water as proposed by Mobil would result in stimulation and increased production of oil and possible water, as to your Wells 3 and 6?

A Yes, I think that you will probably create an oil bank and that we may receive some slight stimulation from it.

Q When do you expect to conduct this remedial work?

A I have an A F E in my possession here which was approved May 18th, the work is scheduled to begin, I believe, within the next week.

Q And how long would it be before you would be able to make an evaluation as a result of that remedial work, the success of it?

A In this particular well, we should have the results probably within 30 days.

Q And as you mentioned, the particular well, I didn't understand which well it was you are going to conduct work on first.

A Well No. 10, twin well to No. 5.

Q Do you expect to undertake any remedial work with reference to Wells 2, 3 and 6?

A If No. 10 is successful, I believe that wells on all of the other five remaining locations, there is a very good possibility.

Q You mentioned that the increased volume of water which you would anticipate having to handle as a result of injection by Mobil would increase your costs. Do you think those costs would exceed the additional recovery in oil?

A Well, I don't know how long our oil production would be stimulated. Some of the results I have seen from Marathon's

work indicates that we might have a very short stimulation with a long period of substantial water.

I might point out, Mr. Sperling, that if we thought we were going to benefit from your flood, I don't believe we would be objecting to your placing wells offsetting us.

Q When were your wells drilled?

A About 1938.

Q Was that substantially before the wells operated by Mobil, offsetting particularly the 26 well, was drilled, do you know?

A I don't know.

Q I was wondering if they were drilled approximately the same time and if you would explain Mobil's wells being in a more advanced stage of depletion than yours.

A I haven't studied anything other than our lease and I have not studied that a great deal, and I couldn't give you an intelligent answer. I am sure there is a reason for it, but I don't know what it is.

Q Have you made any study to determine whether or not the Mobil 26 well is producing from the same interval as say, your No. 3 well?

A Would you repeat that, please?

Q Have you made any investigation as to whether or not

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the Mobil 26 well is producing from the same zone as your No. 3 Well, or your No. 6 Well?

A I have given a very brief review of the general wells in this area and they are all producing from substantial intervals in the San Andres and I am confident there is a considerable over-lap between the completion in No. 6 and all of our wells.

Q Would you have an opinion, Mr. Lyon, as to whether the proposed expansion could be carried on economically at all, if the interval that you suggest, the buffer there, were adopted?

A I have not made this study and I have an opinion based on very little information. I think that Mobil would substantially improve their position as far as placing this property under waterflood by expanding to the wells which would be available even by leaving off the buffer zone, but, as I say, I have not studied your economics.

Q I think your suggestion was in your statement, that there be a buffer zone of some 1660 feet or something like that between your lease line and the nearest injection well?

A 1650 feet.

MR. NUTTER: That is one thing I wanted to clarify. Did you mean 1650 feet from an injection well to your producing well, or to your lease line?

THE WITNESS: To our lease line.

MR. NUTTER: Excuse me, Mr. Sperling.

Q (By Mr. Sperling) Well that suggestion would eliminate two tiers of proposed injection wells in the expanded area, would it not?

A I don't believe so. We would not have any objections to your placing No. 35 or 48 on injection. This would be standard location in the second row of proration units away from our lease.

Q So in effect, that suggests the elimination of the proposed four injection wells shown, that would be 15, the 29 and the 42, and the proposed well to be drilled?

A No.

Q Not 42?

A Not 42. This is somebody else's business.

MR. NUTTER: I think Mr. Kelly testified Texaco was operating a flood over there?

THE WITNESS: Yes, sir.

MR. SPERLING: That's all I have.

MR. NUTTER: Any further questions of Mr. Lyon? You may be excused.

(Whereupon, witness was excused.)

MR. KELLAHIN: Thank you.

MR. NUTTER: Does anyone wish to present any testimony?

We will call for statements now.

MR. SPERLING: I would like to offer some rebuttal testimony.

MR. NUTTER: O. K.

MR. SPERLING: If you would care to recess at this time, we might be better able to get along faster.

MR. NUTTER: That's a very good idea -- 15 minutes.

(Whereupon, a 15-minute recess was taken.)

MR. NUTTER: The hearing will come to order. Mr. Sperling, do you have your witness?

* * * * *

PAT KELLY

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

(Whereupon, Mobil's Exhibits 6 through 11 marked for identification)

REDIRECT EXAMINATION

BY MR. SPERLING:

Q Mr. Kelly, you are the same Pat Kelly that testified previously for Mobil?

A Yes, sir.

Q You are still under oath?

A Yes, sir.

Q Mr. Kelly, would you refer to what has been re-marked for rebuttal purposes as Mobil's Exhibit No. 6 and indicate what that is?

A Exhibit 6 is a copy of the same plat that we had offered as Exhibit 2 without the colors on it. It is submitted for the purpose of showing four log cross-sections identified as A-A Prime, B-B Prime, C-C Prime and D-D Prime.

Q Now would you please refer to what is marked --

A Those are the only two copies of that particular plat. We have the lines of Section R shown on the cross-sections themselves, but the scale is distorted. It is hard to read well numbers off of it.

Q If you will refer to what has been marked as Exhibit 7, Mobil's, identify that, please?

A Exhibit 7 is a log cross-section of A-A Prime which extends in an east-west direction across the north end of the Bridges State lease. It extends from Bridges State Well No. 87 on the west to No. 88 on the east.

This section is submitted for the purpose of identifying what I have referred to earlier as the high porosity or high permeability zone that occurs within the body of the San Andres pay in the north end of the field. It can be seen from this section that the porosity or log porosity in that interval

is quite a lot higher than the rocks immediately adjacent to it.

Q Now, refer to Exhibit 8, please.

A Exhibit 8 is a package of core analysis information on four wells, on four of the wells that are contained within the cross-section identified as A-A Prime. Those four wells are No. 87, 79, 78 and 88. The interval that is colored on Section A-A Prime, denoting the high permeability zone, have been correlated with the core analysis information and can be seen in each of these tabulations of core data that that interval has much higher permeability and permeability of rocks above and below. For example, in Well No. 87, the permeability goes to one twenty-five millidarcies in that interval, has concentrated with eight millidarcies below and one half millidarcies above. In Well 79, the permeability interval goes to 406 millidarcies as concentrated with 9.2 millidarcies above and 5.8 immediately below.

In Well No. 78, the permeability of the high porosity interval goes to 956 millidarcies compared with 20 above and 5 below. It is the order of 900 to 1000 millidarcies in Well No. 88 compared with 16 below and 36 above and, of course, there are streaks running down to less than one-tenth.

I submit these to show that within that interval that I call a high permeability interval that there is a substantial

difference in the quality of the rock or character of the rock.

Q (By Mr. Sperling) Well, now, is this pertinent to Mr. Zeman's testimony concerning his apprehension about channeling?

A I think so. The well in the north part of the field extending on down as far south as our Bridges State No. 8 and 43 and even 23 and 47, in Section 23 and 24, do have a high permeability streak, the one that is identified on this section and then the core analysis data. Not all wells do. Some wells don't, but in every instance where high water production has been noticed early in the life of the flood, this 10 to 20 feet of high porous rock is readily identifiable from whatever data there is available.

In some cases it is a drilling time log in some of those holes. You can find there is an interval in that that falls into where that zone should correlate, that is drilled a lot faster than the rocks above and below it, and so -- we find that it is true that a lot of water production is experienced in the portion of the flood where this streak is present and it is a high expense flood.

We have to fight pretty hard to get the oil, but it is profitable and it is the only way we are going to get it.

Q Would you refer to Exhibit 9, please?

A Exhibit 9 is cross-section B-B Prime which extends north-south direction through extending from the south in the Phillips Petroleum Company Hale No. 7 to Continental's "H" 35, No. 12 "H" 35 8, Mobil's Bridges 95, 99, 96 and 30. This section shows colored in green the intervals that we interpret as being oil saturated porosity, colored in below the oil water contact of approximately minus 698 feet is the interval that we interpret to be saturated with water.

As you can see, Continental's "H" 35 No. 12, which is a twin to Well No. 1 in the southeast corner of the lease, has a nice section of oil-saturated porosity in the second zone. Well No. 2, according to -- which is a twin to Well No. 8 on the section in the northeast corner of the lease is indicated by our work, to be water-saturated throughout the second porosity.

I seem to remember from the test data that this is the best well Continental has. The upper interval is pretty decent in that well. It looks better in the "H" 35 No. 8 than it does in the Bridges 95 to the north. We find that there is some oil-saturated and some water-saturated porosity in the second interval in the second zone and Bridges No. 95 which is a twin to our No. 12 San Andres well.

Likewise, in Bridges 99, which is a twin to proposed injector No. 25, I would like to comment while we are on the

subject of Well No. 25, that that well has been deepened at some time in the past, sufficient to uncover the lower porosity but at the present time it is junked and plugged back to 4579. Which by interpretation is a couple of hundred feet above that lower porosity and it has been equipped for injection the way that it is shown here on the chart. We found a small amount of oil-saturated porosity in the second porosity, in No. 96 and Well No. 30. I might comment at this point on the oil-water content that we are using here. I notice that Marathon portrayed an oil-water contact of minus 750 feet. I think this is what we call the second porosity, the porosity that they have evidently been getting so much oil out of.

We had a drill stem test wherein we produced water at minus 6908 in our Bridges No. 27, in that second porosity and became suspicious at that time that the water level may be that high in that vicinity. We subsequently drilled our Bridges No. 32 which encountered the second porosity a little bit below minus 700 feet and it produced an abundance of water with no oil out of the lower porosity.

So it may be that we have a variation in water level in this area, so the other one of the sections in a moment that the second porosity in the Continental's "H" 35 No. 1, a twin to No. 6, is also indicated by our work to be below the

oil-water contact of minus 698.

Q Does that conclude your comment on Exhibit 10, --
I mean 9? Now refer to Exhibit 10.

A Exhibit 10 is a line section which runs on the south from Getty, formerly Tidewater, State No. 7 in the northwest quarter of Section 36 up to the Marathon State-McAllister No. 8, a twin to San Andres Well No. 3, up to the 6 which is a twin to San Andres Well No. 4, up to our 103 which is a Glorieta Well, and on up to Bridges 105 which was a deep well that has been recently plugged back and perforated for injection in the San Andres.

This section shows that all of the porosity that we picked up in Well No. 103, which is a twin to the well that we want to drill, is below our water level of minus 700 feet, minus 69 feet in the second zone. The upper porosity in that well is awfully thin, perhaps bearing out the low productivity that was experienced on No. 13, a twin, about 330 feet north, which is, I remember producing something like 60,000 barrels before it reached the economic limit and was deepened to the Blinberry.

This section shows once again that the pay improves materially to the south. It would be my opinion that any water injected into 103, assuming that it were not injected

into 103 or a well like it, assuming that it were not injected into water-bearing zone in the base, would have very little likelihood of materially influencing any existing production to the south. It is conceivable that the rocks could be pressured up behind the pipe in those wells where they have been deepened and perforated in the lower zone.

I don't think there is a chance that water would get into that lower interval there, but of course, if we were to drill a well and found oil-saturated lower porosity, we would want to inject into it and attempt to flood it out and introduce it. We have not found anything approaching the prolific nature of the lower porosity production on the Bridges State lease that have been encountered to the south. I think there is a radical difference in the quality of the log.

Q Does that conclude your comments on Exhibit 10?

A Yes, sir.

Q Now, refer to Exhibit marked 11.

A This is a cross-section D-D Prime which extends on the south from Continental's "H" 35 No. 11, a twin to San Andres Well No. 6 up through Mobil's Bridges No. 26, to the Bridges 98, a twin to 33, up to Bridges 30, which has a log on it in the San Andres, this is the well that I mentioned earlier.

If No. 6 has anything in it like No. 11 on the

Continental's "H" 35 lease, by our standards it has no oil-saturated porosity in the second interval. It is conceivable as I said once before, that there is a variable water level in here. I am convinced that we have found water as high as minus 698 and I thought some completion on the State-McAllister wells to be southeast and south that went some distance below that extends to Continental's B. That there is a variable water table in that level. It is conceivable that Continental has more pay in No., the No. 6 well, than is indicated on this "H" 35 No. 11 log because I don't see anything about that log that makes the well look better than the wells that we have to the north and it has produced quite a lot more oil, the order of three times the amount of oil that some of our wells have been getting from the standpoint of cumulative recovery.

Q Do you have any other comment on D?

A I might say that the log on this section, Bridges No. 6, is a Gamma Ray Neutron log and you can see the 5% porosity line that has been drawn there. No porosity has been colored in because there is obviously something wrong with the log. It runs to 40 or 50% porosity which we don't believe is true and the log goes off scale. This well at the present time makes 100% water as the result of a hydromatic plug in the bottom of the well, bringing down and allowing the water to

re-enter the well bore from the bottom, drowning it out.

You can see that its total depth does go below minus 698. Another bit of information that tends to confirm that up in this vicinity, that is water as high as minus 700. The only other thing I have to comment on this section is that No. 30 was shot in the porosity, too, and is of no value in that well in estimating pay thickness. It did have a little bit lower porosity which came in below water. As I have said before, it is our intention to inject into all of the oil-bearing porosity that we can uncover on the lease, or into all of the porosity that is indicated to have oil in it within the pattern being served by that injection well. Most of these cases here, for example, a well drilled south of No. 26 for injection, encountered water-bearing porosity that we seem to have found as present at that, subject into the datum.

We would not intend to inject into there because we would not have any chance of recovering any oil out of it.

Q Is that all the comments you have on D-D Prime?

A Yes, sir. The only other thing that I feel obliged to comment on at this time, it is inconceivable to me that Mobil or anyone else has any business trying to carry on this waterflood to the south end of the Bridges lease without the use of these injection wells situated along the south line.

There is not enough there to flood. We would be wasting our money without any inclusion of the pattern.

Q Is that your reaction to Mr. Lyon's suggesting a barrier of some 1650 feet between the nearest injection well and Continental's lease line?

A Yes, sir, it's inconceivable to me that we could flood it on that basis. We have to go down and flood it all or we haven't anything to flood. The reserves are not all that attractive. This is a pretty doggy end of the field. It is not nearly the same quality as that farther south and we have no alternative but to either give up on it or try to get the reservoir of oil and this is the only way we can do it.

Q I recall a comment you made during a recess, Mr. Kelly, I would ask you to confirm at this time. I think you said that where a barrier like that to be observed that you build a tremendous memorial ^{phenomenal} conversion in the south end of the field.

A Yes, sir, we have a ten thousand barrel per day injection station which has been constructed there in Section 26 in the past few months, together with the distribution lines that have been extended to these wells colored in red.

Q Do you have anything else to add?

A No, sir.

MR. SPERLING: That is all.

MR. NUTTER: Does anyone have any questions of Mr. Kelly?

RE-CROSS EXAMINATION

BY MR. LOPEZ:

Q Mr. Kelly, in these last four exhibits, when you showed these water levels, did you actually physically test each of these wells?

A No, sir. I summarized the test data that oil-water contact is based on. It is based on a drillstem test in Bridges State No. 27. I don't have the details of the test here which produced water at minus 698 feet. It is based also on a production test of the lower porosity in our Bridges 132 which was in the vicinity of minus 700 feet and produced an abundant supply of water and no oil and it is also based on the recent watering out of our Bridges State No. 26 which I attribute to the introduction of bottom water through the lower porosity which had been opened in the well when it was first drilled. Water was tested in it then, and a hydromatic plug was set in the bottom of the well until recently when eventually the plug broke down because the supply of water came in on the well and drowned it out.

This has taken place there just the past few weeks and that well is bottom of close to minus 700 feet.

Q Isn't it true that we have already established there is a great variation, that the testimony of Mr. Zeman was 750,000, you said 698?

A Yes, 52 feet.

Q Right, so based on -- do you think just based on 3 test wells that you can establish this pattern reliably?

A I accept that as reliable information insofar as Section 26 is concerned. Over half of it has been condemned below minus 700 by three separate tests.

Q You mentioned the wells 132, 27 and 36, is that correct?

A Yes, sir. I might mention also that when we drilled 127 which is the northeast in the southwest corner of Section 24, in early 1968, we acidized and tested the lower porosity without getting anything out of it. I accepted that as evidence that it did not have water in it, true or not, and 127 picked up that porosity low enough to produce water. If it had communicated between it and No. 27 to the south, so there are variations in permeability evidently in the lower porosity, which impede the flow of fluids all over.

Q Are all these contacts drawn at 698?

A No, sir. They are just close. The minus 698 figure resulted out of drillstem tests in Bridges No. 27. The log of 132 had been placed in evidence and I could arrive at the exact datum that we got it from there, if you were to look at this time. It was in the vicinity of minus 700 feet

that the well picked up the lower porosity. In the case of No. 26, I see that it was drilled 25 or 26 feet below minus 698 and produced water when it was initially drilled in the bottom, cemented off, and it has recently produced a lot of water again.

I don't think it is coming out of the upper porosity. I don't believe we have ever produced any water out of the upper porosity in meaningful amounts. All of these sections which cross the south line of the Bridges State lease confirm, in my mind, at least, that there is nothing like the high permeability, high porosity zone, that we have in the north end. Those logs look very similar to the logs of wells that have not experienced premature break-through of water.

MR. LOPEZ: I will pass the witness on to you.

RE-CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Kelly, if I understand, you base your oil-water contact of 698 or about 700, on the basis of water encountered in two wells?

A Three wells.

Q Were there any wells where water was encountered at a lower level?

A Well, of course, our Bridges No. 132 went well below

minus 700.

Q And had no water?

A It did have water but as I remember, the porosity came up to about minus 700 feet and it produced 100% water. We did not get any oil at all out of the bottom zone.

Q Where did you encounter the water then, are you saying it was at 700 then?

A I know it was present up to there at that point and I know in Bridges 27 it was present.

Q You know, of course, that it was not present on the Marathon's lease?

A Yes, sir, I accept that.

Q But you won't say it is not possible the same situation exists on the Continental lease?

A It could be. There is nothing peculiar about the "H" 35 No. 11 well. As I mentioned earlier, the pay that I see in it is no better than the pay we have and yet the well has three hundred seventy or eighty thousand barrels of oil.

Q Now you refer to the south end of the pool as being rather doggy?

A I am talking about Bridges State lease which is situated on -- it starts at the south line of Section 26 and goes north and in general it deteriorates to the north.

Q You are talking about Mobil's lease and not Continental's or --

A Yes, I am talking about Mobil's lease.

Q Are you familiar with Phillips Petroleum Company offset to Continental's No. 4 well?

A No. 4 to the east or south?

Q To the west.

A I have had occasion to look at some production figures on it.

Q That was completed as a top allowable well last year, was it not?

A It may have been.

Q I think the production figures that I looked at were in the 1968 Annual, and I will refresh my memory on that. I think the well you are referring to is a twin well, was completed in 1969.

A A brand new well?

Q Yes, sir.

MR. NUTTER: Are you talking about the Mobil Lease, Mr. Kellahin?

MR. KELLAHIN: Yes.

MR. NUTTER: Are you talking about No. 2 or No. 1?

MR. KELLAHIN: No. 3.

MR. NUTTER: Where is No. 3, it is not on the map.

MR. KELLAHIN: It is a twin to the No. 1 well.

Q (By Mr. Kellahin) Do you have any information on that well?

A I see that the No. 1 well is credited with making 1,068 barrels in the year 1968 and was producing about a barrel and a half a day at the year end.

MR. NUTTER: The No. 1?

THE WITNESS: The No. 1.

MR. NUTTER: The No. 3 was drilled as a twin to the No. 1 and depleted in the Grayburg-San Andres?

MR. KELLAHIN: Yes, that is our question.

THE WITNESS: I don't know that to be true.

MR. KELLAHIN: You don't have that information?

MR. LOPEZ: Mr. Kelly, on this cross section, C-C 1, for Marathon No. 8, you indicate the water contact to be at about 4712. However it is a fact that we have drilled that well to 4763 on porosity and make less than 1% water. How would you get that? Does that not indicate that your calculations here are incorrect?

THE WITNESS: No, sir. That indicates that water wasn't made from that well and from that interval. We have had an initial drillstem test and two confirmations, what appears to

me to be a higher water level in the Bridges lease.

I would be tickled pink if it had oil in it.

MR. NUTTER: How would you account then for 4712 making less than one per cent?

THE WITNESS: At 4712 we are into water. I don't see it showing up on the log correlation that you are in a separate reservoir. Perhaps there is a tilted water level, various possibilities.

MR. LOPEZ: I have no further questions, Mr. Examiner.

MR. SPERLING: I offer Mobil's Exhibits 6 through 11.

MR. HATCH: In both cases?

MR. SPERLING: Both.

MR. NUTTER: Mobil's Exhibits 6 through 11 will be admitted in evidence in cases 4367 and 4368.

(Whereupon, Mobil's Exhibits 6 through 11 offered and admitted in evidence.)

MR. NUTTER: Do you have any further questions?

MR. SPERLING: That is all I have, Mr. Examiner.

MR. NUTTER: Do you have any further questions of Mr. Kelly?

MR. KELLAHIN: I would like to request that the Examiner take administrative notice of the Commission's own records in regard to Phillips, namely No. 3 located in Unit "E", Section

17 South, 34 East.

MR. NUTTER: Section 35?

MR. KELLAHIN: 34 East.

MR. NUTTER: We will take administrative notice of the existence of that well.

MR. KELLAHIN: And the monthly statistical reports for the month of March which shows production from that well was 77 barrels.

MR. NUTTER: In the Grayburg-San Andres?

MR. KELLAHIN: Vacuum.

MR. NUTTER: Thank you, Mr. Kellahin. We will take notice of that fact. Is there any further testimony by any parties? We will call for statements at this time.

Mr. Sperling, as applicant, you can go last.

MR. SPERLING: All right, sir.

MR. KELLAHIN: If the Examiner please, on behalf of Continental Oil Company, I think our position is quite clear. Our chief concern is that with a lease not yet ready for secondary recovery and if we are offset by waterflood project, that production from that lease will be damaged. We feel Mobil will suffer no damage by delaying the injection in those wells immediately adjacent to the Continental lease and we ask that insofar as those wells immediately offsetting Continental Oil

Company are concerned, the injection application be denied.

MR. NUTTER: Thank you. Mr. Lopez?

MR. LOPEZ: Mr. Examiner, just a brief statement, with reference to higher members of the Bar that are chopping at the bit, I would like to make our position very clear, though. We would question that there would be established that buffer zone as has been requested by Continental of 1650 feet. This would affect us on the north and east or west boundaries of the Marathon lease and I shall adopt Mr. Kellahin's brief statement as coinciding with our own.

I think it is clear that to allow this application by Mobil at this time is premature especially as it affects the various successful leases of Marathon to the South of the Mobil application and that great reserves, oil reserves, could be irretrievably lost and that the expense that Marathon has gone to line the wells and to properly develop and retrieve the oil under that lease would be lost. Thank you.

MR. NUTTER: Thank you. Mr. Sperling?

MR. SPERLING: In answer to Mr. Kellahin's statement which is an obvious conclusion that no damage will result to Mobil by delaying until such time as Continental has decided that it is propitious time to commence a waterflood, I think the evidence supports the conclusion irrefutably that Mobil

will suffer great damage economically and that the possibility of the loss of considerable amounts of oil is established.

The evidence, I think, has shown that there is a distinct possibility of separate reservoirs existing between the Bridges lease and those leases which are not far removed from it. There is a mass of data here which the Examiner and his staff are going to have to digest over a period of time, in order to reach a conclusion, and the resolution of what now appears, at least from the standpoint of Continental and Marathon, a near irreconcilable dilemma. If all of the statements and the testimony is taken at face value, it looks to me like there is possibly equitable consideration to both sides which the Commission is going to have to weigh at some point.

I don't think it is the Commission's position in the past that the waterflood should be delayed until such time as it might be convenient to conduct a companion or neighboring flood. I think it has been shown that the possibility of the damage insofar as the adjoining leases are concerned is simply that it is a possibility and by no means a probability. And we therefore ask the favorable consideration of the Commission on the application.

MR. NUTTER: Thank you. Mr. Kelly, before you get away, I've got the latest tests from Marathon and from

Continental on their wells. I wonder if you could give me the latest tests in your wells, particularly in Sections 26 and 25, if you have got the oil and water tests, to date.

MR. KELLY: I don't have the recent tests of the wells on the south end of the Bridges lease. The most recent information I have is with regard to their producing ability, is the production report that I estimated in an earlier tabulation which comes up through the month of April, I believe, for our wells.

MR. NUTTER: Do you have tests on the wells more recent than that?

MR. KELLY: Of course we do, but I don't have them with me. I would be pleased to obtain the most recent tests that we have from our records and forward them to you.

MR. NUTTER: If you would do that, please, Mr. Kelly, if you can give me the tests on the wells in the south half and the northeast quarter of Section 26 and the north half of 25.

MR. LOPEZ: Could we be supplied with a copy?

MR. NUTTER: I am sure he would be happy to supply copies to interested parties.

MR. KELLY: Yes, sir, the south half of Section 26?

MR. NUTTER: North half of 25 and the northeast quarter and south half of 26, please.

MR. KELLY: I know there is only one well still producing in the southeast quarter of Section 26. The others are depleted and drilled deeper to some other zone or temporarily abandoned.

MR. NUTTER: Whatever they are capable of, let us know. Does anyone have anything else they would like to offer in Case No. 4367 and Case No. 4368, consolidated? The case will be taken under advisement.

I N D E X

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STATE OF NEW MEXICO)
) ss
 COUNTY OF BERNALILLO)

I, the undersigned Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me; and that the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

Louisa Gonzales
 Notary Public

My Commission Expires:

3-26-74

I do hereby certify that the foregoing is a complete record of the proceedings in the Bernalillo County Oil and Gas Conservation Commission. 4367-68
 Notary Public for the State of New Mexico
[Signature]
 Notary Public for the State of New Mexico



OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO

P. O. BOX 2068 - SANTA FE

87801

GOVERNOR
DAVID F. CARGO
CHAIRMAN

LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER

STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

June 29, 1970

Mr. James E. Sperling
Modrall, Seymour, Sperling, Roehl &
Harris
Attorneys at Law
Albuquerque, New Mexico

Re: Case No. 4367
Order No. R-3983
Applicant:
Mobil Oil Corporation

Dear Sir:

Enclosed herewith are two copies of the above-referenced Commission order recently entered in the subject case.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

Copy of order also sent to:

Hobbs OCC x

Artesia OCC

Aztec OCC

Other Mr. Owen Lopez and Mr. Jason Kellahin

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE No. 4367
Order No. R-3983

APPLICATION OF MOBIL OIL CORPORATION
FOR A WATERFLOOD EXPANSION, LEA COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on June 10, 1970,
at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 29th day of June, 1970, the Commission, a
quorum being present, having considered the testimony, the record,
and the recommendations of the Examiner, and being fully advised
in the premises,

FINDS:

(1) That due public notice having been given as required by
law, the Commission has jurisdiction of this cause and the subject
matter thereof.

(2) That the applicant, Mobil Oil Corporation, seeks
authority to expand its Bridges State Waterflood Project, Vacuum
Grayburg-San Andres Pool, by the injection of water into the
Grayburg and San Andres formations through two additional injec-
tion wells to be drilled at locations in Sections 25 and 26,
Township 17 South, Range 34 East, NMPM, Lea County, New Mexico,
as follows:

A well to be drilled at a standard location
2310 feet from the North line and 860 feet
from the West line of Section 25; and

A well to be drilled at an unorthodox loca-
tion 100 feet from the South line and 1980
feet from the West line of Section 26.

--2--

CASE No. 4367
Order No. R-3983

(3) That the injection of water through said wells may cause waste and may violate correlative rights of the offset operators to the south of each of the proposed locations.

(4) That the subject application should be denied.

IT IS THEREFORE ORDERED:

(1) That the subject application is hereby denied.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

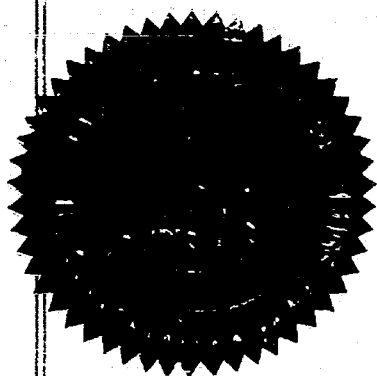
DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION


DAVID F. CARGO, Chairman


ALEX J. ARMIGO, Member


A. L. PORTER, Jr., Member & Secretary



EST/

Docket No. 14-70

DOCKET: EXAMINER HEARING - WEDNESDAY - JUNE 10, 1970

9 A.M. - OIL CONSERVATION COMMISSION CONFERENCE ROOM,
STATE LAND OFFICE BUILDING - SANTA FE, NEW MEXICO

The following cases will be heard before Daniel S. Nutter, Examiner, or
Elvis A. Utz, Alternate Examiner:

CASE 4363: Application of Jack L. McClellan for unorthodox gas well location, Roosevelt County, New Mexico. Applicant, in the above-styled cause, seeks approval of an unorthodox gas well location for his Atlantic Federal Well No. 1 located 2130 feet from the South line and 660 feet from the East line of Section 24, Township 8 South, Range 37 East, Bluit-San Andres Associated Pool, Roosevelt County, New Mexico. The S/2 of said Section 24 to be dedicated to said well.

CASE 4364: Application of Roy E. Kimsey, Jr., for a non-standard oil proration unit, Lea County, New Mexico. Applicant, in the above-styled cause, seeks the approval of a 120-acre non-standard oil proration unit comprising the N/2 SW/4 and SE/4 SW/4 of Section 24, Township 9 South, Range 34 East, Jenkins-Cisco Pool, Lea County, New Mexico, to be dedicated to his Mounsey Well No. 1-Y located in Unit N of said Section 24.

CASE 4365: Application of Benson-Montin-Greer Drilling Corporation for amendment of special pool rules, Rio Arriba County, New Mexico. Applicant, in the above-styled cause, seeks the amendment of Rule 1 of the Special Rules and Regulations governing the East and West Puerto Chiquito-Mancos Oil Pools to provide that wells completed or recompleted in the Mancos formation within one mile of said pools shall be spaced, drilled, operated, and produced in accordance with the Special Rules and Regulations governing said pools.

CASE 4366: Application of Mobil Oil Corporation for down-hole commingling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to commingle production from the Vacuum-Wolfcamp and Vacuum-Upper Pennsylvanian Pools in the well-bore of its Bridges State Well, No. 109, a triple completion, located in Unit N of Section 24, Township 17 South, Range 34 East, Lea County, New Mexico.

CASE 4367: Application of Mobil Oil Corporation for a waterflood expansion, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to expand its Bridges State Waterflood Project, Vacuum Pool, by the drilling of an additional water injection well at an unorthodox location 100 feet from the South line and 1980 feet from the West line of Section 26, Township 17 South, Range 34 East, Lea County, New Mexico.

Examiner Hearing - June 10, 1970

-2-

Docket No. 14-70

CASE 4368: Application of Mobil Oil Corporation for a water flood expansion and amendment of rules governing same, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to expand its Bridges State Waterflood Project, Vacuum Pool, by the conversion to water injection of 13 additional wells and the drilling of one additional water injection well, all at standard locations in the N/2 of Section 25, Section 26, and E/2 of Section 27, Township 17 South, Range 34 East, Lea County, New Mexico. Applicant further seeks the amendment of the rules governing said project to permit expansion of the project administratively without a showing of well response.

CASE 4369: In the matter of the hearing called by the Oil Conservation Commission on its own motion to permit Anadarko Production Company and all other interested persons to appear and show cause why the Anadarko Samwell No. 1, located in Unit B of Section 15, Township 19 South, Range 29 East, Turkey Track-Queen Pool, Eddy County, New Mexico, should not be plugged and abandoned in accordance with a Commission-approved plugging program.

E #
368

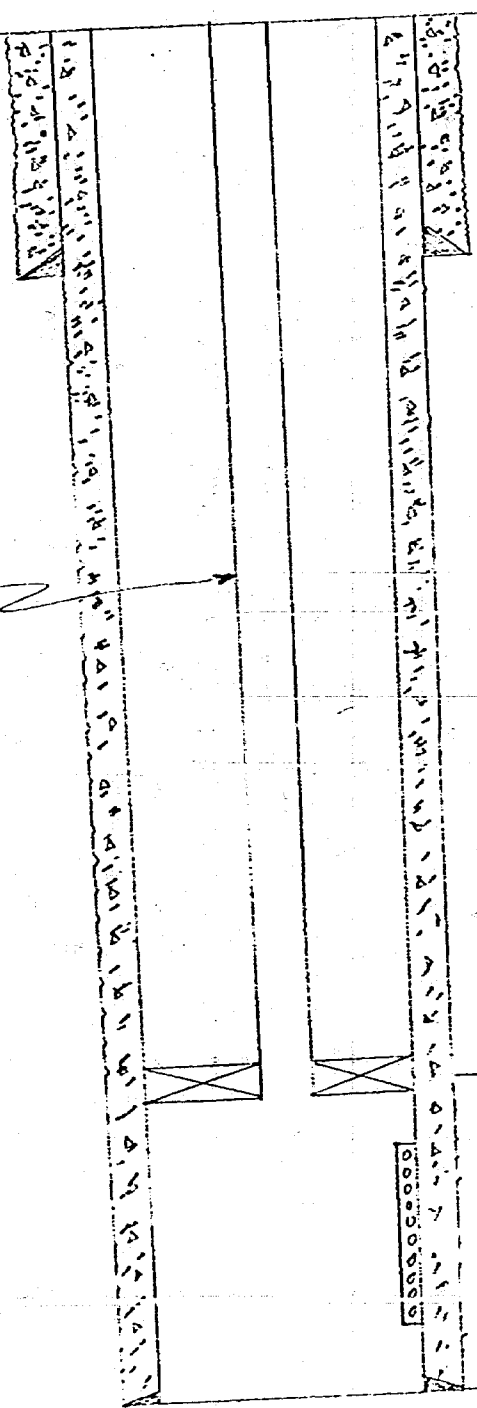
EX 5

DIAGRAMMATIC WELL SKETCH
WIW TO BE DRILLED UNIT-E - S25
T17S R34E
VACUUM (GRAYBURG-SAN ANDRES) POOL
LEA COUNTY, NEW MEXICO

BEFORE EXAMINED NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 53
CASE NO. 4368 4367

8 5/8"

2 3/8" C.L. Tubing



INT PKR. 4450'
SAN ANDRES Perforations
4500' - 4850'

4 1/2" 9.5" J-55
4900'

4900' TD

CASE 4367

NMOCC

DIAGRAMMATIC WELL SKETCH
WIW TO BE DRILLED IN UNIT "N" S 26 T 17 S
VACUUM (GRAYBURG-SAN ANDRES) POOL R34E
LEA COUNTY, NEW MEXICO

8 5/8"

2 3/8" C.L. Tubing

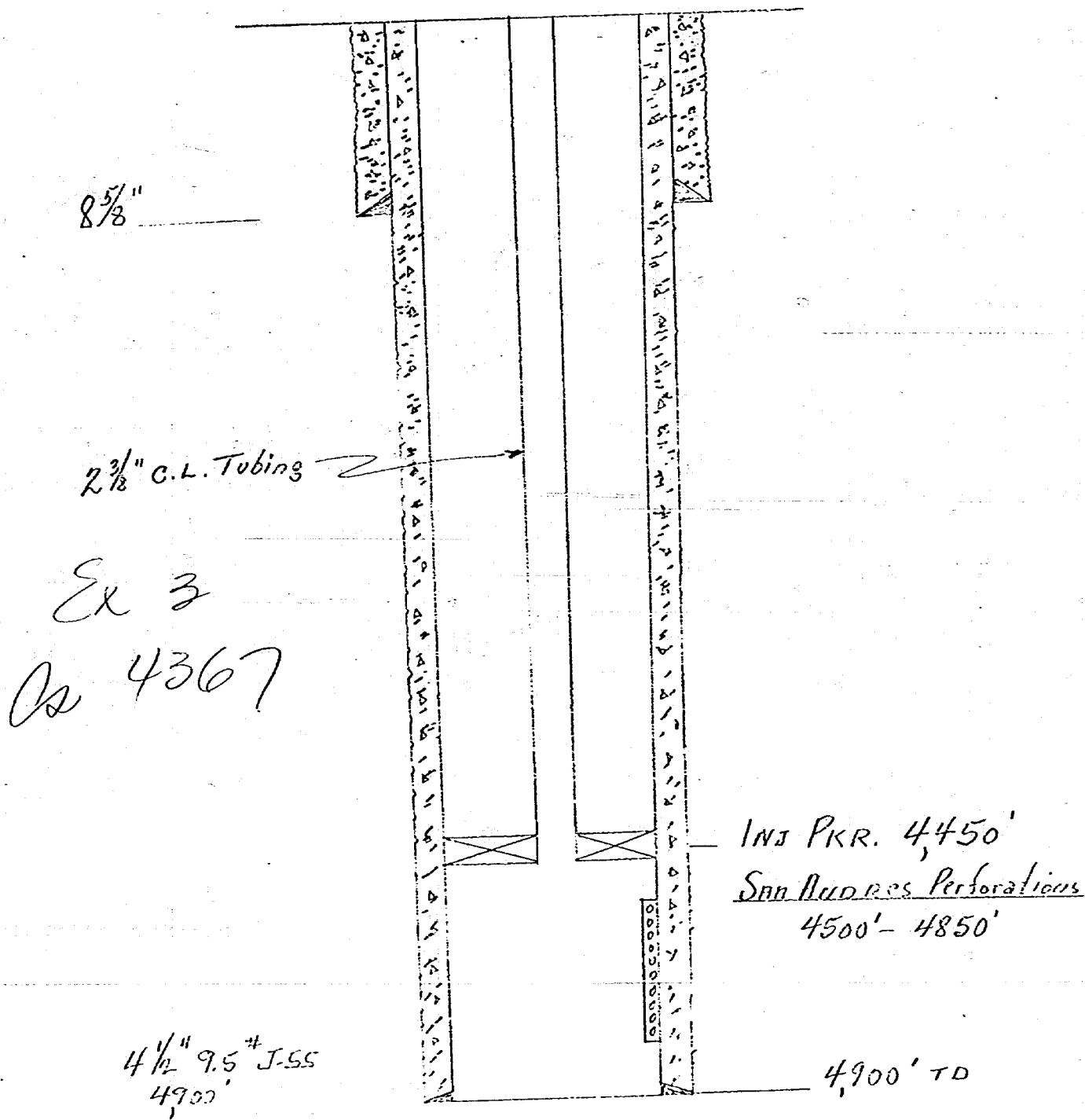
BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 3
CASE NO. 4367

INT PKR. 4450'
SAN ANDRES Perforations
4500' - 4850'

4 1/2" 9.5" J-55
4900'

4900' TD

DIAGRAMMATIC WELL SKETCH
 WIW'S TO BE DRILLED
 VACUUM (GRAYBURG-SAN ANDRES) POOL
 LEA COUNTY, NEW MEXICO



TABULATION OF PRODUCTION
MOBIL - BRIDGES STATE LEASE
VACUUM GBSA FIELD, LEA COUNTY, N. M.

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Appl EXHIBIT NO. 4
CASE NO. 4367

Well No. 11				Well No. 12				Well No. 13				Well	
Date				Date				Date				Date	
Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Mo. Yr. Oil, Bbls.	
Cumulative Oil 1-1-60				Cumulative Oil 1-1-60				Cumulative Oil 1-1-60				Cumulative Oil 1-1-	
	99,346				311,246				59,497			295,471	
60	1,257	2,920		60	12,447	25,662	1,333	60	0	0		60	12,451
61	1,321	3,632		61	11,240	20,446	1,391	61	0	0		61	11,240
62	1,154	2,528		62	10,192	26,445	1,209	62	0	0		62	10,192
63	104	289		63	11,786	14,859	1,113	63	0	0		63	10,286
64	0	0		64	10,036	28,920	936	64	0	0		64	10,036
65	0	0		65	9,306	43,285	939	65	0	0		65	9,306
66	0	0		66	8,908	44,962	604	66	0	0		66	8,038
67	0	0		67	12,639	50,568	616	67	0	0		67	6,885
68	0	0		68	14,814	28,015	860	68	0	0		68	7,736
Cumulative Oil 1-1-69				Cumulative Oil 1-1-69								Cumulative Oil 1-1-	
	103,182				412,614							381,641	
J 69	0	0		J 69	907	1,175	60		0	0		J 69	365
F	0	0		F	1,137	1,004	50		0	0		F	591
M	0	0		M	3,252	1,139	163		0	0		M	1,707
A	0	0		A	4,076	1,022	204		0	0		A	2,140
M	0	0		M	4,239	909	212		0	0		M	2,225
J	0	0		J	899	1,072	77		0	0		J	456
J	0	0		J	691	725	74		0	0		J	532
A	0	0		A	627	613	60		0	0		A	567
S	0	0		S	663	720	28		0	0		S	387
O	0	0		O	683	776	28		0	0		O	398
N	0	0		N	737	797	74		0	0		N	429
D	0	0		D	786	883	131		0	0		D	458
Total				Total	18,697	10,835	1,161					Total	10,255
Cumulative Oil to 5-1-70 103,182				Cumulative Oil to 5-1-70 434,052				Cumulative Oil to 5-1-70 69,497				Cumulative Oil to 5-1-70	
J 70	0			J 70	697	853	100			0		J 70	391,896
F	0			F	610	812	76			0		F	421
M	0			M	578	813	72			0		M	381
A				A	856	1,424	95			0		M	362
Cumulative Oil to 5-1-70 103,182				Cumulative Oil to 5-1-70 434,052				Cumulative Oil to 5-1-70 69,497				Cumulative Oil to 5-1-70	
Cumulative Oil to 5-1-70 103,182				Cumulative Oil to 5-1-70 434,052				Cumulative Oil to 5-1-70 69,497				Cumulative Oil to 5-1-70	

TABULATION OF PRODUCTION
MOBIL - BRIDGES STATE LEASE
VACUUM GBSA FIELD, LEA COUNTY, N. M.

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Apple EXHIBIT NO. 4
CASE NO. 4367

Well No. 12				Well No. 13				Well No. 15			
Date	Mo.	Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Date	Mo.	Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.
Wtr, Bbls.	Mo.	Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Wtr, Bbls.	Mo.	Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.
Cumulative Oil 1-1-60				Cumulative Oil 1-1-60				Cumulative Oil 1-1-60			
			311,246						295,471		
60	12	447	25,662	1,333		60	0	0	12,451	7,173	0
61	11	240	20,446	1,391		61	0	0	11,240	9,359	375
62	10	192	26,445	1,209		62	0	0	10,192	9,004	1,169
63	11	786	14,859	1,113		63	0	0	10,286	8,585	2,354
64	10	036	28,920	936		64	0	0	10,036	15,428	2,002
65	9	306	43,285	939		65	0	0	9,306	16,981	1,241
66	8	908	44,962	604		66	0	0	8,038	14,182	1,418
67	12	639	50,568	616		67	0	0	6,885	8,706	279
68	14	814	28,015	860		68	0	0	7,736	8,079	327
Cumulative Oil 1-1-69				Cumulative Oil 1-1-69				Cumulative Oil 1-1-69			
			412,614						381,641		
J 69	907	1,175	60	0	0	J 69	365	673	29		
F	1,137	1,004	50	0	0	F	591	743	25		
M	3,252	1,139	163	0	0	M	1,707	851	81		
A	4,076	1,022	204	0	0	A	2,140	764	102		
M	4,239	909	212	0	0	M	2,225	680	106		
J	899	1,072	77	0	0	J	456	774	38		
J	691	725	74	0	0	J	532	796	60		
A	627	613	60	0	0	A	567	752	60		
S	663	720	28	0	0	S	387	1,168	28		
O	683	776	28	0	0	O	398	1,256	28		
N	737	797	74	0	0	N	429	1,211	17		
D	786	883	131	0	0	D	458	1,251	0		
Total	18,697	10,835	1,161			Total	10,255	10,919	574		
Cumu. 1-1-70	431,311			Cumu. 1-1-70	69,497			Cumu. 1-1-70	391,896		
J 70	697	853	100			J 70	421	1,245	30		
F	610	812	76			F	381	1,218	51		
M	578	813	72			M	362	1,219	48		
A	856	1,424	95			A	412	712	0		
Cumulative Oil						Cumulative Oil					
to 5-1-70	434,052					to 5-1-70	393,472				

TABULATION OF PRODUCTION
MOBIL - BRIDGES STATE LEASE
VACUUM GBSA FIELD, LEA COUNTY, N. M.

Well No. 25				Well No. 26				Well No. 29			
Date				Date				Date			
Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.
Cumu. 1-1-60	122,114			Cumu. 1-1-60	126,310			Cumu. 1-1-60	157,537		
60	4,986	16,254		60	1,669	7,029	3,822	60	3,208	19,180	0
61	4,643	19,525		61	1,620	5,986	4,769	61	2,452	19,819	0
62	4,043	12,001		62	1,446	6,505	6,510	62	2,022	22,014	0
63	6,041	20,173	120	63	1,297	4,226	4,740	63	1,566	12,019	122
64	8,437	18,276	0	64	1,646	3,633	440	64	1,317	17,675	0
65	3,709	11,120	0	65	1,701	6,463	22	65	1,216	14,645	0
66	2,724	8,182	62	66	1,336	1,063	998	66	992	24,102	15
67	2,743	5,805	189	67	659	0	1,326	67	1,281	26,164	12
68	3,289	9,513	449	68	657	0	1,765	68	1,521	17,567	121
Cumu. 1-1-69	162,729			Cumu. 1-1-69	138,341			Cumu. 1-1-69	173,112		
J 69	174	1,101	60	J 69	35	0	180	J 69	69	174	30
F	284	1,226	50	F	56	0	153	F	112	192	25
M	813	1,391	163	M	163	0	489	M	325	169	81
A	1,019	1,248	204	A	203	0	609	A	407	168	102
M	1,059	1,110	212	M	212	0	636	M	424	170	106
J	219	1,275	33	J	2	0	6	J	103	168	26
J	240	1,231	30	J	0	0	0	J	94	118	30
A	239	1,103	30	A	0	0	0	A	90	80	30
S	193	1,133	28	S	55	0	2,750	S	111	1,167	28
O	199	1,219	28	O	57	0	2,850	O	114	1,257	29
N	215	1,175	18	N	0	0	0	N	123	1,161	31
D	229	1,215	0	D	0	0	0	D	131	1,140	33
Total	4,883	14,427	856	Total	783	0	7,673	Total	2,103	5,964	551
Cumu. 1-1-70	167,612			Cumu. 1-1-70	139,124			Cumu. 1-1-70	175,215		
J 70	203	1,173	28	J	16	0	192	J	97	909	29
F	178	1,117	51	F	25	0	300	F	76	779	25
M	169	1,119	48	M	24	0	288	M	72	779	24
A	221	356	0	A	32	0	384	A	69	1,001	23
Cumu. 5-1-70	168,383			Cumu. 5-1-70	139,221			Cumu. 5-1-70	175,529		

TABULATION OF PRODUCTION
CONOCO - STATE H-35 LEASE
VACUUM GBSA FIELD, LEA COUNTY, N. M.

Well No. 2			
Date	Oil, Bbls.	Gas, MCF	Wtr, Bbls.
Mo. Yr.			
Cumu. 1-1-60	324,271		
60	12,019	2,565	0
61	12,544	12,122	0
62	12,667	17,484	0
63	13,840	8,541	0
64	13,793	6,285	0
65	13,140	8,150	0
66	14,565	8,290	0
67	16,154	5,679	0
68	17,719	1,305	0
Cumu. 1-1-69	450,712		
J 69	1,572	402	0
F	1,471	377	0
M	1,489	381	0
A	1,529	391	0
M	1,515	388	0
J	1,501	384	0
J	1,642	420	0
A	1,641	420	0
S	1,538	394	0
O	1,647	684	0
N	1,581	656	0
D	1,639	680	0
Total	18,765	5,577	
Cumu. 1-1-70	469,477		
J	1,426	592	0
F	1,471	466	0
M	1,624	515	0
Cumu. 4-1-70	473,998		

Well No. 3			
Date	Oil, Bbls.	Gas, MCF	Wtr, Bbls.
Mo. Yr.			
Cumu. 1-1-60	322,684		
60	12,018	2,599	0
61	12,543	8,169	0
62	12,668	8,305	0
63	13,839	15,085	0
64	13,793	11,577	0
65	13,140	12,261	0
66	14,089	10,495	16
67	11,790	6,163	0
68	9,861	1,057	0
Cumu. 1-1-69	436,425		
J 69	838	325	0
F	785	305	0
M	794	308	0
A	790	307	0
M	814	316	0
J	806	313	0
J	881	342	0
A	881	342	0
S	827	321	0
O	840	311	0
N	805	298	0
D	834	309	0
Total	9,895	3,797	0
Cumu. 1-1-70	446,320		
J 70	777	287	0
F	750	484	0
M	867	559	0
Cumu. 4-1-70	448,714		

Well No. 6			
Date	Oil, Bbls.	Gas, MCF	Wtr, Bbls.
Mo. Yr.			
Cumu. 1-1-60	285,888		
60	7,533	8,347	0
61	7,454	28,919	0
62	7,925	32,168	0
63	8,442	15,770	0
64	8,621	14,014	248
65	5,197	6,920	0
66	3,252	4,492	46
67	3,464	5,220	0
68	3,994	1,090	0
Cumu. 1-1-69	341,770		
J 69	314	325	0
F	305	316	0
M	298	308	0
A	306	317	0
M	337	349	0
J	311	322	0
J	365	378	0
A	365	378	0
S	342	354	0
O	249	311	31
N	239	299	30
D	247	309	31
Total	3,678	3,966	92
Cumu. 1-1-70	345,448		
J 70	230	288	29
F	222	351	37
M	224	355	37
Cumu. 4-1-70	346,124		

TABULATION OF PRODUCTION
CONOCO - STATE H-35 LEASE
VACUUM GBSA FIELD, LEA COUNTY, N. M.

Well No. 2			Well No. 3				Well No. 6					
Ds.	Gas, MCF	Wtr, Bbls.	Date		Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Date		Oil, Bbls.	Gas, MCF	Wtr, Bbls.
			Mo.	Yr.				Mo.	Yr.			
271			Cumul. 1-1-60		322,684			Cumul. 1-1-60		285,888		
019	2,565	0		60	12,018	2,599	0		60	7,533	8,347	0
544	12,122	0		61	12,543	8,169	0		61	7,454	28,919	0
667	17,484	0		62	12,668	8,305	0		62	7,925	32,168	0
840	8,541	0		63	13,839	15,085	0		63	8,442	15,770	0
793	6,285	0		64	13,793	11,577	0		64	8,621	14,014	248
140	8,150	0		65	13,140	12,261	0		65	5,197	6,920	0
565	8,290	0		66	14,089	10,495	16		66	3,252	4,492	46
154	5,679	0		67	11,790	6,163	0		67	3,464	5,220	0
719	1,305	0		68	9,861	1,057	0		68	3,994	1,090	0
712			Cumul. 1-1-69		436,425			Cumul. 1-1-69		341,770		
572	402	0	J	69	838	325	0	J	69	314	325	0
771	377	0	F		785	305	0	F		305	316	0
89	381	0	M		794	308	0	M		298	308	0
29	391	0	A		790	307	0	A		306	317	0
15	388	0	M		814	316	0	M		337	349	0
01	384	0	J		806	313	0	J		311	322	0
42	420	0	J		881	342	0	J		365	378	0
41	420	0	A		881	342	0	A		365	378	0
38	394	0	S		827	321	0	S		342	354	0
47	684	0	O		840	311	0	O		249	311	31
81	656	0	N		805	298	0	N		239	299	30
39	680		D		834	309	0	D		247	309	31
65	5,577		Total		9,895	3,797	0	Total		3,678	3,966	92
77			Cumul. 1-1-70		446,320			Cumul. 1-1-70		345,448		
26	592	0	J	70	777	287	0	J	70	230	288	29
71	466	0	F		750	484	0	F		222	351	37
24	515	0	M		867	559	0	M		224	355	37
98			Cumul. 4-1-70		448,714			Cumul. 4-1-70		346,124		

TABULATION OF PRODUCTION
MARATHON-MCALLESTER STATE LEASE
VACUUM GBSA FIELD - LEA COUNTY, N. M.

Well No. 2				Well No. 3				Well No. 4			
Date				Date				Date			
Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.	Mo. Yr.	Oil, Bbls.	Gas, MCF	Wtr, Bbls.
Cumu. 1-1-60	316,744			Cumu. 1-1-60	309,902			Cumu. 1-1-60	306,248		
60	12,673	14,364		60	12,674	12,941		60	12,674	13,056	0
61	11,988	7,607		61	12,145	8,505		61	12,428	14,855	0
62	12,900	6,668		62	12,835	6,360		62	12,794	15,940	0
63	10,927	10,927	34	63	13,068	8,177		63	13,052	13,826	0
64	13,887	14,247	148	64	13,869	8,648		64	13,781	11,316	0
65	13,876	20,551	135	65	13,998	10,726		65	13,997	13,264	0
66	14,675	14,313	237	66	17,157	10,685		66	16,943	23,725	0
67	8,995	4,967	271	67	17,194	10,305		67	19,447	23,647	0
68	12,913	12,864	810	68	18,065	7,804	664	68	14,492	15,033	0
Cumu. 1-1-69	429,578			Cumu. 1-1-69				Cumu. 1-1-69	435,856		
J 69	1,899	1,483	122	J 69	1,960	407	30	J 69	1,470	902	0
F	1,765	877	110	F	1,848	898	0	F	1,324	1,482	0
M	1,932	1,062	118	M	1,990	1,061	29	M	1,427	1,754	0
A	1,891	1,157	814	A	1,819	1,080	27	A	1,397	1,911	0
M	1,188	876	1,188	M	2,239	875	27	M	1,079	1,448	0
J	1,093	866	1,093	J	2,380	999	29	J	749	1,543	0
J	1,209	903	1,209	J	2,359	934	28	J	796	1,544	0
A	1,360	1,012	1,360	A	2,635	1,120	34	A	804	1,553	0
S	2,022	1,036	0	S	3,537	1,036	0	S	1,287	1,712	0
O	1,374	1,416	1,374	O	2,561	1,486	0	O	875	2,030	0
N	1,254	1,188	1,254	N	2,338	1,249	23	N	798	1,704	0
D	1,166	942	1,166	D	2,248	1,433	22	D	768	1,438	0
Total	18,153	12,818	9,808	Total	27,914	12,578	249	Total	12,774	19,121	
Cumu. 1-1-70	447,731			Cumu. 1-1-70	468,821			Cumu. 1-1-70	448,630		
J 70	1,055	942	1,055	J	2,232	1,574	22	J	2,057	1,165	523
F	547	371	547	F	2,190	1,170	23	F	1,986	2,950	20
M	1,229	782	819	M	2,486	1,249	26	M	2,165	3,055	21
Cumu. 4-1-70	450,562			Cumu. 4-1-70	475,729			Cumu. 4-1-70	454,838		

MOBIL OIL CORPORATION
CALCULATION OF WATERFLOOD
RESERVES FOR BRIDGES STATE NO. 26
VACUUM GBSA FIELD, LEA COUNTY, N. M.

First assume that:

- (1) Pattern will remain open on the south and will be influenced only by WIWs Nos. 15, 29 and 35.
- (2) Closed pattern reserves = 1/2 of primary ultimate and open pattern reserve = 1/4 of primary ultimate

<u>Well No.</u>	<u>Primary Oil to 1-1-70 MB</u>	<u>Remaining Primary to 1-1-70 MB</u>	<u>Ultimate Primary MB</u>
15	367	50	417
26	137	0	137
29	170	7	107
35	105	2	<u>177</u>
			838

If each well is draining 40 acres, the primary oil in this pattern is

$$\frac{838 \text{ MB}}{160 \text{ Acres}} = 5238 \text{ Bbls./Acre}$$

The swept area if pattern remains open on the south is 40 acres and waterflood reserves are:

$$5238 \times 1/4 \times 40 \text{ Acres} = 52 \text{ MB}$$

Now assume the pattern is closed by a drilled injection well located 560 feet south of Well No. 26.

The swept area then becomes 55 acres and the waterflood reserves:

$$5238 \times 1/2 \times 55 \text{ acres} = 144 \text{ MB}$$

The oil that will be lost if the pattern is not closed on the south is then:

$$144 - 52 = 92 \text{ MB}$$

PWKelly/lh
6-8-70

BEFORE EXAMINER NUTTER	
OIL CONSERVATION COMMISSION	
EXHIBIT NO. <u>5</u>	
CASE NO. <u>4367</u>	

GEO. HATCH

Mobil Oil Corporation respectfully requests permission to expand the Grayburg San Andres waterflood operations on the Bridges State lease in the Vacuum Field, Lea County, New Mexico, to include 15 additional water injection wells situated at orthodox and unorthodox locations in Sections 25, 26, and 27, T-17-S, R-34-E. Of the total of 15 new water injection wells, two are proposed for drilling, one at an orthodox location in Unit "E" of Section 25 and the other at an unorthodox location in Unit "N" of Section 26.

The Vacuum Grayburg San Andres Field, found at a depth of approximately 4500', was discovered in August 1929 and has produced under a solution gas primary mechanism throughout the northern portion and is thought to be influenced by a water drive in the south. Cumulative primary oil from the field to the end of 1969 was approximately 125 MM barrels.

The Bridges State lease of Mobil Oil Corporation produced on primary until pilot waterflood operations were initiated in the northern part in December 1958. Pilot injection was through 6 wells initially which was expanded to 8 injectors in May 1963. Results of the pilot justified expansion of the flood which was accomplished in October 1967 to include a total of 30 injectors. Performance of the expanded flood has progressed to the point where it is now necessary to expand injection operations throughout the remainder of the developed portion of the Bridges State lease.

Documents submitted in support of this application include a plat showing the locations of the proposed injection wells, together with diagrammatic sketches of each such well and all of the injection well logs that are available. There is also a graph depicting performance of the flood since 1965. A copy of this request with attachments is being furnished the State Engineer.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION
OF MOBIL OIL CORPORATION FOR
AUTHORITY TO EXPAND THE WATERFLOOD
PROJECT ON ITS STATE BRIDGES LEASE
IN THE VACUUM (GRAYBURG-SAN ANDRES)
POOL - LEA COUNTY, NEW MEXICO, BY
THE DRILLING OF AND INJECTING INTO
TWO WELLS

Case No. 4367

A P P L I C A T I O N

1. Mobil Oil Corporation hereby requests authority to expand the waterflood project on its State Bridges Lease in the Vacuum (Grayburg-San Andres) Pool, Lea County, New Mexico, by the drilling of two wells, as hereinafter designated and identified, for use as water injection wells in the Grayburg-San Andres Sand at an approximate depth of 4700 feet below the surface.

<u>Location</u>	<u>Section</u>	<u>Unit Letter Designation</u>
1980' FWL & 100' FSL	26	N
2310' FNL & 860' FWL	25	E

The above wells are located in Township 17 South, Range 34 East, N.M.P.M.

2. The subject waterflood project was established under the authority of Commission Order No. R-1244, issued September 17, 1958, and expanded under the authority of Commission Orders No. R-3318, issued September 12, 1967, and No. R-3496, issued September 12, 1968.

3. Applicant holds the water rights to 1200-acre feet per annum from the Ogallala zone, and that three water supply wells have been drilled having a total capacity of approximately 22,000 barrels per day. The water which is being presently produced in connection with the operation

of the project is being re-injected into the Grayburg-San Andres formation and produced water within the proposed expansion area will likewise be re-injected. Average injection rates for these proposed injection wells is estimated to be 500 barrels per day per well.

4. A copy of this application has been sent to the office of the State Engineer of New Mexico, and each offsetting operator has been notified of the proposed injection wells described in this application.

5. The granting of this application will result in the prevention of waste and will protect correlative rights in the project area.

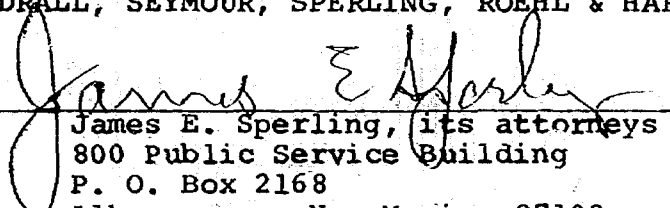
WHEREFORE, Applicant requests that this matter be set for hearing before an examiner and that thereafter the Commission issue its order approving the drilling of the injection wells as hereinabove set forth.

Respectfully submitted,

MOBIL OIL CORPORATION

BY: MODRALL, SEYMOUR, SPERLING, ROEHL & HARRIS

By


James E. Sperling, its attorneys
800 Public Service Building
P. O. Box 2168
Albuquerque, New Mexico 87103

DRAFT

GMH/esr

June 17, 1970

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

[Signature]
CASE No. 4367

Order No. R- 3983

APPLICATION OF MOBIL OIL CORPORATION
FOR A WATERFLOOD EXPANSION, LEA COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on June 10, 1970,
at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this day of June, 1970, the Commission, a
quorum being present, having considered the testimony, the record,
and the recommendations of the Examiner, and being fully advised
in the premises,

FINDS:

(1) That due public notice having been given as required by
law, the Commission has jurisdiction of this cause and the subject
matter thereof.

(2) That the applicant, Mobil Oil Corporation, seeks
authority to expand its Bridges State Waterflood Project, Vacuum
Grayburg-San Andres Pool, by the injection of water, through two
additional injection wells to be drilled at locations in Sec-
tions 25 and 26, Township 17 South, Range 34 East, NMPM, Lea
County, New Mexico, as follows:

into the Grayburg and to enter formation

A well to be drilled at a standard location
2310 feet from the North line and 860 feet
from the West line of Section 25; and

A well to be drilled at an unorthodox loca-
tion 100 feet from the South line and 1980 feet
from the West line of Section 26.

(3) That the injection of water through said wells may cause waste and may violate correlative rights of the offset operators to the south of each of the proposed locations.

(4) That the subject application should be denied.

IT IS THEREFORE ORDERED:

(1) That the subject application is hereby denied.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

Case Number

4367

Application
Transcripts.

Small Exhibits

ETC.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE No. 4367 (de novo)
Order No. R-3983-A

APPLICATION OF MOBIL OIL CORPORATION
FOR A WATERFLOOD EXPANSION, LEA COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing de novo at 9 a.m. on September 16, 1970, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 10th day of November, 1970, the Commission, a quorum being present, having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That after an examiner hearing, Commission Order No. R-3983, dated June 29, 1970, was entered denying the request of the applicant, Mobil Oil Corporation, for permission to expand its Bridges State Waterflood Project, Vacuum Grayburg-San Andres Pool, by the injection of water into the Grayburg and San Andres formations through two additional injection wells to be drilled in Sections 25 and 26, Township 17 South, Range 34 East, NMPM, Lea County, New Mexico, as follows:

A well to be drilled at a standard location
2310 feet from the North line and 860 feet
from the West line of Section 25; and

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CASE No. 4367 (de novo)
Order No. R-3983-A

A well to be drilled at an unorthodox location
100 feet from the South line and 1980 feet from
the West line of Section 26.

(3) That the applicant requested and was granted a hearing de novo before the Oil Conservation Commission.

(4) That the applicant was granted permission to amend the application to permit the conversion to water injection of its Bridges State Well No. 13, located in Unit E of said Section 25, in lieu of the well to be drilled in said unit and to inject into the Grayburg and Upper San Andres formations only in lieu of the entire Grayburg and San Andres formations.

(5) That there are substantial reserves of oil in the Lower San Andres formation on the Marathon McAlister Lease offsetting said Well No. 13 to the south.

(6) That because of the manner in which said Well No. 13 was originally completed there is a reasonable probability that said Well No. 13 cannot be completed for water injection in the Upper San Andres formation in such a manner that water injected would be confined to the Upper San Andres formation only.

(7) That the escape of water into the Lower San Andres formation as described in Finding No. (6), above, would cause premature water breakthrough into wells on the Marathon McAlister Lease, thereby reducing the oil productivity of the wells and reducing the ultimate recovery from the lease.

(8) That there are substantial reserves of oil in the Upper and Lower San Andres formation on the Continental State H-35 Lease to the south of the above-described injection well to be drilled at an unorthodox location in said Section 26.

(9) That there are numerous wells on said Continental Lease completed open-hole in both the Upper and Lower San Andres formation.

(10) That because of the manner in which said Continental wells were completed there is a reasonable probability that water injected through said injection well in Section 26 into the Upper San Andres formation will escape into the Lower San Andres formation through said open-hole completions.

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CASE No. 4367 (de novo)

Order No. R-3983-A

(11) That the injection of water into the Upper San Andres formation, and the escape of water into the Lower San Andres formation as described in Finding No. (10), above, would cause premature water breakthrough into wells on the Continental lease, thereby reducing the oil productivity of the wells and reducing the ultimate recovery from the lease.

(12) That offset producing wells to the south of each of the subject injection wells have recoverable reserves in the Grayburg and Upper and Lower San Andres formations that would be swept away from said producing wells if the requested injection were permitted.

(13) That the injection of water through said wells would cause waste and would violate the correlative rights of offset operators to the south of each of the proposed locations.

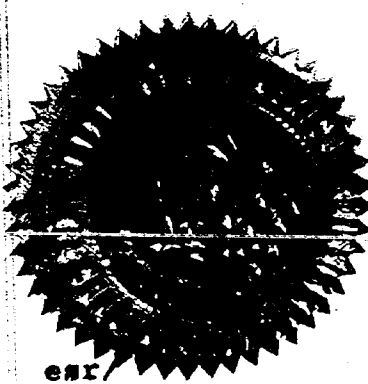
(14) That the subject application should be denied.

IT IS THEREFORE ORDERED:

(1) That the subject application is hereby denied.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.



STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

David F. Cargo
DAVID F. CARGO, Chairman

Alex J. Armijo
ALEX J. ARMIGO, Member

A. L. Porter, Jr.
A. L. PORTER, Jr., Member & Secretary

ear

WAIVER OF OBJECTION

Phillips Petroleum Company has received notice of the intention of Mobil Oil Corporation to pursue a waterflood expansion application under Case No. 4367 and 4368 on September 16, 1970. Phillips also understands that a request will be made by Mobil for authority to inject water into Bridges State Well No. 29 which is a north offset to the Phillips Mabel Lease in the W/2 of the NW/4 of Section 35, T-17-S, Range 34 East. Phillips has no objection to the Mobil application.

Phillips Petroleum Company

By:

K S Blanchard

Docket No. 21-70

DOCKET: REGULAR HEARING - WEDNESDAY - SEPTEMBER 16, 1970

OIL CONSERVATION COMMISSION - 9 A.M. - MORGAN HALL, STATE LAND OFFICE BUILDING,
SANTA FE, NEW MEXICO

ALLOWABLE: Consideration of the allowable production of gas for October, 1970, from fifteen prorated pools in Lea, Eddy, Roosevelt and Chaves Counties, New Mexico. Consideration of the allowable production of gas from nine prorated pools in San Juan, Rio Arriba and Sandoval Counties, New Mexico, for October, 1970.

CASE 4367: (De Novo)

Application of Mobil Oil Corporation for a waterflood expansion, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to expand its Bridges State Waterflood Project, Vacuum Grayburg-San Andres Pool, by the injection of water into the Grayburg San Andres formations through two additional injection wells to be drilled at locations in Township 17 South, Range 34 East, Lea County, New Mexico, as follows:

A well to be drilled at a standard location 2310 feet from the North line and 860 feet from the West line of Section 25; and

A well to be drilled at an unorthodox location 100 feet from the South line and 1980 feet from the West line of Section 26.

Upon application of Mobil Oil Corporation this case will be heard De Novo under the provisions of Rule 1220.

CASE 4368: Application of Mobil Oil Corporation for a waterflood expansion and amendment of rules governing same, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to expand its Bridges State Waterflood Project, Vacuum Grayburg-San Andres Pool, to the conversion of water injection of 13 additional wells at standard locations in Sections 25, 26, and 27, Township 17 South, Range 34 East, Lea County, New Mexico. Applicant further seeks the amendment of the rules governing said project to permit expansion of the project administratively without a showing of well response.

Upon application of Mobil Oil Corporation this case will be heard De Novo under the provisions of Rule 1220.

THE FOLLOWING CASES WILL BE HEARD BEFORE DANIEL S. NUTTER, EXAMINER,
OR ELVIS A. UTZ, ALTERNATE EXAMINER, IN THE OIL CONSERVATION COMMISSION
CONFERENCE ROOM ON THE SECOND FLOOR OF SAID BUILDING AT 9:30 A.M.

CASE 4413: (Continued from the August 19, 1970, Examiner Hearing)
In the matter of the hearing called by the Oil Conservation Commission upon its own motion to permit Stanley Leonard Jones dba Francisca Corporation and all other interested parties to appear and show cause why the Francisca Corporation Beeman Well No. 1 located 1980 feet from the South and West lines of Section 2, Township 24 South, Range 28 East, Eddy County, New Mexico, should not be plugged and abandoned in accordance with a Commission-approved plugging program.

CASE 4416: (Continued for the September 2, 1970, Examiner Hearing)
Application of Robert L. Parker Trust for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a cooperative waterflood project in the Langlie Mattix Pool on its George L. Erwin Lease by the injection of water through its Erwin Well No. 2 located in Unit L of Section 35, Township 24 South, Range 37 East, Lea County, New Mexico.

CASE 4424: Southeastern New Mexico nomenclature case calling for an order for the extensions of certain pools in Lea, Eddy, Chaves and Roosevelt Counties, New Mexico:

a) Extend the Blinebry Oil Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 21 SOUTH, RANGE 36 EAST, NMPM
SECTION 25: SE/4

b) Extend the Bluitt-San Andres Associated Pool in Roosevelt County, New Mexico, to include therein:

TOWNSHIP 8 SOUTH, RANGE 38 EAST, NMPM
SECTION 17: SE/4

c) Extend the South-Carlsbad Morrow Gas Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 23 SOUTH, RANGE 26 EAST, NMPM
SECTION 1: W/2

d) Extend the Double L-Queen Pool in Chaves County, New Mexico, to include therein:

TOWNSHIP 14 SOUTH, RANGE 29 EAST, NMPM
SECTION 25: SW/4
SECTION 36: NE/4 NW/4

e) Extend the Eagle Creek-San Andres Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 25 EAST, NMPM
SECTION 22: E/2 NE/4

f) Extend the Lusk-Morrow Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 19 SOUTH, RANGE 32 EAST, NMPM
SECTION 32: All

(Case 4424 continued)

- g) Extend the Midway-San Andres Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 37 EAST, NMPM
SECTION 16: SW/4

- h) Extend the West Sawyer-San Andres Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 9 SOUTH, RANGE 37 EAST, NMPM
SECTION 34: S/2

- i) Extend the North Vacuum-Abo Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
SECTION 11: SW/4

- j) Extend the North Vacuum-Morrow Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
SECTION 14: N/2
SECTION 15: E/2

- k) Extend the Vada-Pennsylvanian Pool in Lea and Roosevelt Counties, New Mexico to include therein:

TOWNSHIP 8 SOUTH, RANGE 35 EAST, NMPM
SECTION 34: NW/4

TOWNSHIP 8 SOUTH, RANGE 36 EAST, NMPM
SECTION 27: SE/4
SECTION 28: NE/4

TOWNSHIP 9 SOUTH, RANGE 33 EAST, NMPM
SECTION 24: All
SECTION 25: NE/4

TOWNSHIP 9 SOUTH, RANGE 34 EAST, NMPM
SECTION 19: N/2 and SW/4

TOWNSHIP 9 SOUTH, RANGE 35 EAST, NMPM
SECTION 16: SE/4

CASE 4425: Application of Eastern Petroleum Company as agent for Southern Gulf Production Company for an unorthodox gas well location, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks as an exception to the gas well location requirements of the Commission Rules and Regulations, approval for the Southern Gulf

CASE 4367: Application of MOBIL
OIL CORP. FOR A HEARING DE NOVO -
SEPTEMBER 16, 1970.

Case Number

4367

Application
Transcripts.

Small Exhibits

ETC.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE No. 4367 (de novo)
Order No. R-3983-A

APPLICATION OF MOBIL OIL CORPORATION
FOR A WATERFLOOD EXPANSION, LEA COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing de novo at 9 a.m. on September 16, 1970, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 10th day of November, 1970, the Commission, a quorum being present, having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That after an examiner hearing, Commission Order No. R-3983, dated June 29, 1970, was entered denying the request of the applicant, Mobil Oil Corporation, for permission to expand its Bridges State Waterflood Project, Vacuum Grayburg-San Andres Pool, by the injection of water into the Grayburg and San Andres formations through two additional injection wells to be drilled in Sections 25 and 26, Township 17 South, Range 34 East, NMPM, Lea County, New Mexico, as follows:

A well to be drilled at a standard location
2310 feet from the North line and 860 feet
from the West line of Section 25; and

-2-

CASE No. 4367 (de novo)

Order No. R-3983-A

A well to be drilled at an unorthodox location
100 feet from the South line and 1980 feet from
the West line of Section 26.

(3) That the applicant requested and was granted a hearing de novo before the Oil Conservation Commission.

(4) That the applicant was granted permission to amend the application to permit the conversion to water injection of its Bridges State Well No. 13, located in Unit E of said Section 25, in lieu of the well to be drilled in said unit and to inject into the Grayburg and Upper San Andres formations only in lieu of the entire Grayburg and San Andres formations.

(5) That there are substantial reserves of oil in the Lower San Andres formation on the Marathon McAlister Lease offsetting said Well No. 13 to the south.

(6) That because of the manner in which said Well No. 13 was originally completed there is a reasonable probability that said Well No. 13 cannot be completed for water injection in the Upper San Andres formation in such a manner that water injected would be confined to the Upper San Andres formation only.

(7) That the escape of water into the Lower San Andres formation as described in Finding No. (6), above, would cause premature water breakthrough into wells on the Marathon McAlister Lease, thereby reducing the oil productivity of the wells and reducing the ultimate recovery from the lease.

(8) That there are substantial reserves of oil in the Upper and Lower San Andres formation on the Continental State H-35 Lease to the south of the above-described injection well to be drilled at an unorthodox location in said Section 26.

(9) That there are numerous wells on said Continental Lease completed open-hole in both the Upper and Lower San Andres formation.

(10) That because of the manner in which said Continental wells were completed there is a reasonable probability that water injected through said injection well in Section 26 into the Upper San Andres formation will escape into the Lower San Andres formation through said open-hole completions.

-3-

CASE No. 4367 (de novo)
Order No. R-3983-A

(11) That the injection of water into the Upper San Andres formation, and the escape of water into the Lower San Andres formation as described in Finding No. (10), above, would cause premature water breakthrough into wells on the Continental lease, thereby reducing the oil productivity of the wells and reducing the ultimate recovery from the lease.

(12) That offset producing wells to the south of each of the subject injection wells have recoverable reserves in the Grayburg and Upper and Lower San Andres formations that would be swept away from said producing wells if the requested injection were permitted.

(13) That the injection of water through said wells would cause waste and would violate the correlative rights of offset operators to the south of each of the proposed locations.

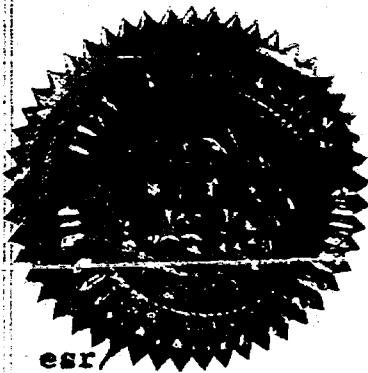
(14) That the subject application should be denied.

IT IS THEREFORE ORDERED:

(1) That the subject application is hereby denied.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.



STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

David F. Cargo
DAVID F. CARGO, Chairman

Alex J. Armijo
ALEX J. ARMIGO, Member

A. L. Porter, Jr.
A. L. PORTER, Jr., Member & Secretary

esr

WAIVER OF OBJECTION

Phillips Petroleum Company has received notice of the intention of Mobil Oil Corporation to pursue a waterflood expansion application under Case No. 4367 and 4368 on September 16, 1970. Phillips also understands that a request will be made by Mobil for authority to inject water into Bridges State Well No. 29 which is a north offset to the Phillips Mabel Lease in the W/2 of the NW/4 of Section 35, T-17-S, Range 34 East. Phillips has no objection to the Mobil application.

Phillips Petroleum Company

By:

KIS Blanchard

CASE 4416: (Continued for the September 2, 1970, Examiner Hearing)
Application of Robert L. Parker Trust for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a cooperative waterflood project in the Langlie Mattix Pool on its George L. Erwin Lease by the injection of water through its Erwin Well No. 2 located in Unit L of Section 35, Township 24 South, Range 37 East, Lea County, New Mexico.

CASE 4424: Southeastern New Mexico nomenclature case calling for an order for the extensions of certain pools in Lea, Eddy, Chaves and Roosevelt Counties, New Mexico:

- a) Extend the Blinebry Oil Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 21 SOUTH, RANGE 36 EAST, NMPM
SECTION 25: SE/4

- b) Extend the Bluit-San Andres Associated Pool in Roosevelt County, New Mexico, to include therein:

TOWNSHIP 8 SOUTH, RANGE 38 EAST, NMPM
SECTION 17: SE/4

- c) Extend the South-Carlsbad Morrow Gas Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 23 SOUTH, RANGE 26 EAST, NMPM
SECTION 1: W/2

- d) Extend the Double L-Queen Pool in Chaves County, New Mexico, to include therein:

TOWNSHIP 14 SOUTH, RANGE 29 EAST, NMPM
SECTION 25: SE/4 SW/4
SECTION 36: NE/4 NW/4

- e) Extend the Eagle Creek-San Andres Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 25 EAST, NMPM
SECTION 22: E/2 NE/4

- f) Extend the Lusk-Morrow Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 19 SOUTH, RANGE 32 EAST, NMPM
SECTION 32: All

Docket No. 21-70

DOCKET: REGULAR HEARING - WEDNESDAY - SEPTEMBER 16, 1970

OIL CONSERVATION COMMISSION - 9 A.M. - MORGAN HALL, STATE LAND OFFICE BUILDING,
SANTA FE, NEW MEXICO

ALLOWABLE: Consideration of the allowable production of gas for October, 1970, from fifteen prorated pools in Lea, Eddy, Roosevelt and Chaves Counties, New Mexico. Consideration of the allowable production of gas from nine prorated pools in San Juan, Rio Arriba and Sandoval Counties, New Mexico, for October, 1970.

CASE 4367: (De Novo)

Application of Mobil Oil Corporation for a waterflood expansion, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to expand its Bridges State Waterflood Project, Vacuum Grayburg-San Andres Pool, by the injection of water into the Grayburg San Andres formations through two additional injection wells to be drilled at locations in Township 17 South, Range 34 East, Lea County, New Mexico, as follows:

A well to be drilled at a standard location 2310 feet from the North line and 860 feet from the West line of Section 25; and

A well to be drilled at an unorthodox location 100 feet from the South line and 1980 feet from the West line of Section 26.

Upon application of Mobil Oil Corporation this case will be heard De Novo under the provisions of Rule 1220.

CASE 4368: Application of Mobil Oil Corporation for a waterflood expansion and amendment of rules governing same, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to expand its Bridges State Waterflood Project, Vacuum Grayburg-San Andres Pool, to the conversion of water injection of 13 additional wells at standard locations in Sections 25, 26, and 27, Township 17 South, Range 34 East, Lea County, New Mexico. Applicant further seeks the amendment of the rules governing said project to permit expansion of the project administratively without a showing of well response.

Upon application of Mobil Oil Corporation this case will be heard De Novo under the provisions of Rule 1220.

THE FOLLOWING CASES WILL BE HEARD BEFORE DANIEL S. NUTTER, EXAMINER,
OR ELVIS A. UTZ, ALTERNATE EXAMINER, IN THE OIL CONSERVATION COMMISSION
CONFERENCE ROOM ON THE SECOND FLOOR OF SAID BUILDING AT 9:30 A.M.

CASE 4413: (Continued from the August 19, 1970, Examiner Hearing)
In the matter of the hearing called by the Oil Conservation Commission upon its own motion to permit Stanley Leonard Jones dba Francisca Corporation and all other interested parties to appear and show cause why the Francisca Corporation Beeman Well No. 1 located 1980 feet from the South and West lines of Section 2, Township 24 South, Range 28 East, Eddy County, New Mexico, should not be plugged and abandoned in accordance with a Commission-approved plugging program.

(Case 4425 continued)

Production Company Navajo Tocito Well No. 4 at an unorthodox gas well location 2023 feet from the South line and 1157 feet from the West line of Section 10, Township 26 North, Range 18 West, undesignated Pennsylvanian gas pool, San Juan County, New Mexico.

CASE 4426: Application of Texaco Inc. for salt water disposal, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks authority to dispose of produced salt water into the Devonian formation in the open-hole interval from 11,150 feet to 11,750 feet in its Peery Federal Well No. 4 located in Unit A of Section 29, Township 15 South, Range 30 East, Little Lucky Lake-Devonian Pool, Chaves County, New Mexico.

CASE 4427: Application of David F. Fasken for the creation of a new gas pool and special pool rules therefor, and a non-standard gas spacing unit, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks the creation of a new Morrow gas pool for his well located 3630 feet from the South line and 660 feet from the East line of Section 1, Township 21 South, Range 25 East, Eddy County, New Mexico, and for the promulgation of special rules therefor, including a provision for 640-acre spacing units. Applicant further seeks approval of a 854.62-acre non-standard gas spacing unit comprising all of said Section 1 to be dedicated to the above-described well.

CASE 4428: Application of Texas Oil and Gas Corporation for a non-standard gas spacing unit, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval of an approximately 240-acre non-standard gas proration unit comprising the E/2 NE/4, SW/4 NE/4, W/2 NW/4, and SE/4 NW/4 of Section 11, Township 23 South, Range 26 East, South Carlsbad Field, Eddy County, New Mexico, to be dedicated to a well to be drilled at a standard location in the N/2 of said Section 11 to test any and all formations from the surface of the ground down to and including the Morrow formation.

CASE 4354: (Continued from the July 1, 1970, Examiner Hearing) and the August 5, 1970, Examiner Hearing. Application of Michael P. Grace and Corinne Grace for compulsory pooling, Eddy County, New Mexico. Applicants, in the above-styled cause, seek an order pooling all mineral interests from the surface of the ground down to and including the Morrow formation underlying the N/2 of Section 11, Township 23 South, Range 26 East, South Carlsbad Field, Eddy County, New Mexico, said acreage to be dedicated to a well to be drilled in either the NE/4 NW/4 or the NW/4 NE/4 of said Section 11. Also to be considered will be the costs of drilling said well, a charge for the risk involved, a provision for the allocation of actual operating costs, and the establishment of charges for supervision of said well.

(Case 4424 continued)

- g) Extend the Midway-San Andres Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 37 EAST, NMPM
SECTION 16: SW/4

- h) Extend the West Sawyer-San Andres Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 9 SOUTH, RANGE 37 EAST, NMPM
SECTION 34: S/2

- i) Extend the North Vacuum-Abo Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
SECTION 11: SW/4

- j) Extend the North Vacuum-Morrow Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
SECTION 14: N/2
SECTION 15: E/2

- k) Extend the Vada-Pennsylvanian Pool in Lea and Roosevelt Counties, New Mexico to include therein:

TOWNSHIP 8 SOUTH, RANGE 35 EAST, NMPM
SECTION 34: NW/4

TOWNSHIP 8 SOUTH, RANGE 36 EAST, NMPM
SECTION 27: SE/4
SECTION 28: NE/4

TOWNSHIP 9 SOUTH, RANGE 33 EAST, NMPM
SECTION 24: All
SECTION 25: NE/4

TOWNSHIP 9 SOUTH, RANGE 34 EAST, NMPM
SECTION 19: N/2 and SW/4

TOWNSHIP 9 SOUTH, RANGE 35 EAST, NMPM
SECTION 16: SE/4

CASE 4425: Application of Eastern Petroleum Company as agent for Southern Gulf Production Company for an unorthodox gas well location, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks as an exception to the gas well location requirements of the Commission Rules and Regulations. approval for the Southern Gulf

OIL CONSERVATION COMMISSION

P. O. BOX 2088

SANTA FE, NEW MEXICO 87501

July 31, 1970

Mobil Oil Corporation
P. O. Box 633
Midland, Texas 79701

DOCKET MAILED *Case 4367*
Date *9-2-70*

Attention: Mr. Ira B. Stitt

Re: APPLICATION OF MOBIL OIL CORPORATION
FOR A DE NOVO HEARING BEFORE THE
COMMISSION OF CASES 4367 & 4368
AND THE RESPECTIVE COMMISSION ORDERS
R-3983 & R-3984 PERTAINING TO THE
EXPANSION OF ITS BRIDGES STATE LEASE
WATERFLOOD PROJECT IN THE VACUUM
GRAYBURG-SAN ANDRES POOL, LEA COUNTY,
NEW MEXICO

Gentlemen:

The subject application will be set for hearing de novo
before the Commission at its Regular Hearing on September 16,
1970.

A copy of the docket will be mailed to you a few days
prior to the hearing.

Very truly yours,

GEORGE M. HATCH
Attorney

GMH/esr

C
O
P
Y

Mobil Oil Corporation

July 28, 1970

JUL 28 AM 11 58

P.O. BOX 633
MIDLAND, TEXAS 79701

4367

New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Att: Mr. A. L. Porter, Jr.

APPLICATION OF MOBIL OIL CORPORATION
FOR A DE NOVO HEARING BEFORE THE
COMMISSION OF CASES 4367 & 4368
AND THE RESPECTIVE COMMISSION ORDERS
R-3983 & R-3984 PERTAINING TO THE
EXPANSION OF ITS BRIDGES STATE LEASE
WATERFLOOD PROJECT IN THE VACUUM
GRAYBURG-SAN ANDRES) POOL,
LEA COUNTY, NEW MEXICO

Gentlemen:

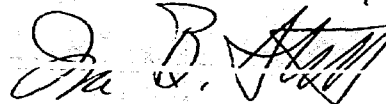
Please refer to Commission Orders R-3983 and R-3984 issued June 29, 1970 as a result of Mobil Oil Corporation's applications in Cases 4367 and 4368 respectively. These cases were heard before the Examiner on June 10, 1970.

The relief requested at this hearing was denied by the Commission.

Pursuant to the Commission Rule 1220, permitting the matter to be heard de novo before the Commission, Mobil Oil Corporation respectfully requests with this application that the Commission grant Mobil a de novo hearing on Orders R-3983 and R-3984 resulting from Cases 4367 and 4368.

Respectfully submitted,

MOBIL OIL CORPORATION



Ira B. Stitt
Division Operations Engineer

WBSimmonsJr/bje

Mobil Oil Corporation

P.O. BOX 633
MIDLAND, TEXAS 79701

MAILED
JUL 28 AM 11 58
JUL 28 1970

July 28, 1970

New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Att: Mr. A. L. Porter, Jr.

*Case
4367*

APPLICATION OF MOBIL OIL CORPORATION
FOR A DE NOVO HEARING BEFORE THE
COMMISSION OF CASES 4367 & 4368
AND THE RESPECTIVE COMMISSION ORDERS
R-3983 & R-3984 PERTAINING TO THE
EXPANSION OF ITS BRIDGES STATE LEASE
WATERFLOOD PROJECT IN THE VACUUM
GRAYBURG-SAN ANDRES) POOL,
LEA COUNTY, NEW MEXICO

Gentlemen:

Please refer to Commission Orders R-3983 and R-3984 issued June 29, 1970 as a result of Mobil Oil Corporation's applications in Cases 4367 and 4368 respectively. These cases were heard before the Examiner on June 10, 1970.

The relief requested at this hearing was denied by the Commission.

Pursuant to the Commission Rule 1220, permitting the matter to be heard de novo before the Commission, Mobil Oil Corporation respectfully requests with this application that the Commission grant Mobil a de novo hearing on Orders R-3983 and R-3984 resulting from Cases 4367 and 4368.

Respectfully submitted,

MOBIL OIL CORPORATION

Ira B. Stitt

Ira B. Stitt
Division Operations Engineer

WBSimmonsJr/bje

DRAFT

GMH/esr
10/16/70

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE No. 4367 (de novo)

Order No. R-3983-A

APPLICATION OF MOBIL OIL CORPORATION
FOR A WATERFLOOD EXPANSION, LEA COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing de novo at 9 a.m. on September 16, 1970, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this _____ day of November, 1970, the Commission, a quorum being present, having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That after an examiner hearing, Commission Order No. R-3983, dated June 29, 1970, was entered denying the request of the applicant, Mobil Oil Corporation, for permission to expand its Bridges State Waterflood Project, Vacuum Grayburg-San Andres Pool, by the injection of water into the Grayburg and San Andres formations through two additional injection wells to be drilled in Sections 25 and 26, Township 17 South, Range 34 East, NMPM, Lea County, New Mexico, as follows:

A well to be drilled at a standard location
2310 feet from the North line and 860 feet
from the West line of Section 25; and

A well to be drilled at an unorthodox location
100 feet from the South line and 1980 feet from
the West line of Section 26.

(3) That the applicant requested and was granted a hearing de novo before the Oil Conservation Commission.

(4) That the applicant was granted permission to amend the application to permit the conversion to water injection of its Bridges State Well No. 13, located in Unit E of said Section 25, in lieu of the well to be drilled in said unit and to inject ^{only} into the Grayburg and Upper San Andres formations in lieu of the ~~entire~~ Grayburg and San Andres formations.

(5) That there are substantial reserves of oil in the Lower San Andres formation on the Marathon McAlister Lease affecting said well No. 13 to the south.

(6) That because of the manner in which said well No. 13 was originally completed there is a reasonable probability that said well No. 13 cannot be completed for water injection in the Upper San Andres formation in such a manner that water injected would be confined to the Upper San Andres formation only.

(7) That the escape of water into the Lower San Andres formation as described in Finding No. (6), above, would cause premature water breakthrough into wells on the Marathon McAlister Lease, thereby reducing the oil productivity of the wells and reducing the ultimate recovery from the lease.

(10) Because of the manner in which said Continental wells were completed there is a reasonable probability that water injected through said injection well in Section 26 ~~completes~~ into the upper San Andres formation will escape into the lower San Andres formation through said open-hole completion.

injection of water into the Upper San Andres formation, and the

(11) That the escape of water into the lower San Andres formation as described in Finding No. (10), above, would cause premature water breakthrough into wells on the Continental lease, thereby reducing the oil productivity of the wells and reducing the ultimate recovery from the lease.

(12) ~~That~~ That offset producing wells to the south of each of the subject injection wells have recoverable reserves in the Grayburg ^{and Lower} and Upper San Andres formations that would be swept away from said producing wells if the requested injection were permitted.

(13) ~~That~~ That the injection of water through said wells would cause waste and would violate the correlative rights of offset operators to the south of each of the proposed locations.

(14) ~~That~~ That the subject application should be denied.

IT IS THEREFORE ORDERED:

(1) That the subject application is hereby denied.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

dearnley-meier reporting service, inc.

SPECIALIZING IN: DEPOSITIONS, HEARINGS, STATEMENTS, EXPERT TESTIMONY, DAILY COPY, CONVENTIONS

209 SIMMS BLDG. • P.O. BOX 1092 • PHONE 243-6691 • ALBUQUERQUE, NEW MEXICO

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
September 16, 1970

REGULAR HEARING

IN THE MATTER OF:

Application of Mobil Oil
Corporation for a waterflood
expansion, Lea County,
New Mexico.

Case No. 4367
(De Novo)

AND

IN THE MATTER OF:

Application of Mobil Oil
Corporation for a waterflood
expansion and amendment of
rules governing same, Lea
County, New Mexico.

Case No. 4368

BEFORE: A. L. Porter, Jr., Member & Secretary
Alex J. Armijo, Member

Volume II

TRANSCRIPT OF HEARING

(Whereupon, the Hearing was reconvened at 9:00 A.M., on September 17, 1970.

MR. PORTER: The Hearing will come to Order.

Mr. Lopez, I believe we had concluded with Marathon's first witness. Will you call your next witness?

MR. LOPEZ: If the Commission please, I would like to call Mr. Paxton.

JOHN W. PAXTON

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

DIRECT EXAMINATION

BY MR. LOPEZ:

Q Would you please state your full name and with whom you are employed?

A I am John W. Paxton. I live in Midland, Texas. I am employed by Marathon Oil Company on the District Engineer's Staff. I specialize in waterflood projects.

Q Did you testify previously in this case?

A I have not testified in this case before.

Q Are you familiar with the vacuum field in Lea County, New Mexico?

A I have studied the performance of the waterflood.

Q And you are familiar with the Application of

Mobil Oil in these two cases we are hearing today?

A Yes, I am.

Q Have you testified before the New Mexico Oil Conservation Commission before and are your qualifications a matter of record?

A I have.

MR. LOPEZ: Are his qualifications acceptable?

MR. PORTER: Yes.

BY MR. LOPEZ:

Q Mr. Paxton, have you prepared or had prepared under your supervision some exhibits in this case?

A Yes, I have.

Q Referring to Exhibit No. 6, Marathon Exhibit No. 6, would you please describe to the Commission what this exhibit stands for?

A This is a map showing the north portion of the Vacuum field. It shows Mobil's Bridges State Waterflood Project outlined in green on the map and Grayburg-San Andres wells are shown in the code or legend at the bottom of the map with a small dot and a circle around it; Mobil's injection wells and proposed injection wells are shown by the circle and the other operators' injection wells are shown on here also. This is the large circle on

the map. The wells that were to be drilled under this Application are shown in the triangle. Wells producing from the deeper horizons are shown as small dots on the map.

Q Isn't it true, now, that Mobil as a matter of record has abandoned their proposal to drill the two new wells indicated by triangles and rather convert, at some future date, Well No. 13 that is indicated by the black dot directly north of Marathon-McCallister Lease?

A Yes, I understand that they have withdrawn their application to drill.

Q Were you ever made aware before yesterday morning of Mobil's intent to change its Application?

A No, I was not.

Q Do you have anything further to offer in connection with this exhibit?

A I have a color code on this exhibit showing the time sequence that Mobil was able to put on injections. Their initial pilot injection wells that were put on in 1958 are shown in green; their expansions in 1963 are lavender; the 1967 and '68 expansion which came very close to the same time are in orange and blue respectively. Their current proposed waterflood

expansion is shown by the red injection wells. This map is effective based on information we had in June of this year.

Q Now, referring to Marathon's Exhibit No. 7, would you please explain to the Commission what this means or what your studies produced?

A Yes, sir. I was interested in the performance of Mobil's waterflood. I plotted the performance of 22 injection wells in their pilot area. Beginning with Figure "1" in this booklet, I will discuss this in more detail than the ones later on. I have shown on these curves, the average daily oil producing rate each year for producing wells in the pilot area. I plotted the oil in the solid black line and the water in a dash line. At the top of this figure, I show the configuration of wells with the injection wells coded on the map. The number of the well, the plotted data for it is indicated on here and the year that the particular injection well was converted to injection is also shown. I have shown on these figures the cumulative oil prior to waterflood. This is here to give us an idea as to what kind of well it had been before. I show on here the oil that was produced during waterflood and the

present oil to water ratio for the period of January 1st, 1970 to July 1st, 1970.

To discuss these curves in groups, to save time, the first two curves are the center wells in Mobil's five-spot pilot. This one that we are looking at on Figure 1, we see there waterflood response occurring in 1961. Then it increased in 1964 after Mobil apparently increased their injection rates. The peak oil rate on this curve is 44 barrels per day and the peak water production rate is 126 barrels per day. This high water production is a characteristic of essentially all of the curves in this exhibit.

Going to Figure No. 2, a very similar performance from this well. In both of these center wells we see production produced during the waterflood approaching that that was produced before waterflood.

Then the next group of wells, five wells located on the outside of Mobil's pilot area, we go first to No. 54.

Q Is this on Figure 4 or Figure 3?

A I skipped a figure.

Q Yes, you skipped a figure.

A I am sorry. Let me go back to Figure 3. The group of wells that are plotted here I will point out

right now to save time in picking them up. I will begin with No. 59 located in Section 13 near the west line. We go from 59 to 54, 55, 34 and then 67. This is a group of wells that experienced a one and two-way push from the injection wells, you will be able to see by the configuration at the top of the exhibit. This Figure No. 3, Well No. 59, shows performance very similar to the center producing wells, however, the oil rate does not approach that of the center wells, reaching 21 barrels per day in 1964 and the water rate has risen up to 90 barrels per day.

Going on to Figure No. 4, this well had a two-way push in 1958 and then in 1967 it benefited from a four-way push as a result of the 1967 expansion. Typically, we see that during the waterflood program, these wells have not produced the quantity of oil that the center wells did. Their response is substantially less throughout.

Going on to Figure No. 5, again, in this case a one-way push for a period of time from 1958 until 1963; then a two-way push from '63 until '67 when it was made a center producer four-way push. Again, lesser response than the center well and higher water production up to 135 barrels per day in this group here which is

typical of the rest of the wells in this group.

We see on Figure No. 6 and Figure No. 7, very large volumes of water from Wells Nos. 6 and 7. We went off scale here and reached 368 barrels per day in the year 1965.

Then, those interested in the next row of wells --

Q (Interrupting) Beginning with Figure No. 8?

A Yes, we will go to Figure No. 8 for Well No. 24.

These wells were converted to injection in 1967, so I examined the production from the time the pilot was initiated until they were put on injection. This row of wells begins with No. 24 in the southwest corner of Section 13 and moves southwest through 21 and into 7 and then back up to No. 31 northwest and then into 62. Looking at the configuration, we see an injection well that was put on in 1958 and there are two producing wells on a line in between the injection well and Well No. 24. This particular well was the best of this group in its response. It reached 15 barrels per day of oil and 38 barrels of water per day. Typically, this group of wells was very slightly affected by the injection program as we can see, turning to Figure No. 9

and Figure No. 10, Figure No. 11, Figure No. 12, this curve on Well -- on Figure No. 13, doesn't belong to any particular group. This was plotted because of my interest in the performance of wells in this flood. I understand that the reports are in error so I will not discuss this further.

No. 10 Well is another that doesn't belong to any particular group that benefited from only a one-way push from 1963 until 1967 when the expansion put it in a four-way push. It received some response after 1963, and then in 1967 it responded substantially and predominantly in water production. It reached a maximum water production, it is off scale on this curve, at 420 barrels per day. The well received a good response on the oil production going to 61 barrels per day early in 1969. But again you see the large volume of water produced in this well.

Then the next group of wells are eight wells that are located in the expansion area that was started in 1967 and 1968. The first six of these are center producers. The first one that I have plotted here is on Figure No. 15, Well, No. 9, located in the south part of Section 13. This is the best of this group.

Its response reached 122 barrels of oil per day in June of 1969 and has suffered a very sharp decline since then to the rate of 61 barrels per day in June of 1970. The water production is increasing rapidly. At this time, having reached a rate of 79 barrels of water per day in June of 1970.

Figure No. 16, probably more typical of this group of wells was in a four-well push. Its response occurred apparently in January of 1969. The water and oil appeared about the same time. The oil rate reached about 99 barrels per day in February of 1969 and then 118 barrels per day in June of that year. The water production has increased steadily since response and still trends upward. In June of 1970 it reached 217 barrels per day average. This is another curve that is characterized by rapidly increasing water rates and sharply declining oil producing rates.

No. 53 shown on Figure 17, very similarly, this well reached 232 barrels of water per day. Again we see the sharp decline in oil rates and increasing water rates. It reached 232 barrels of water per day.

Well No. 8 is somewhat anomalous to this group shown on Figure 18. It did not realize the

response that the other wells have which I have no explanation for this.

Pertaining to Figure No. 18, another typical well in this group.

Figure No. 20, a similar situation for this group.

Continuing to Figure No. 21, this well experienced a three-well push, you can see on the configuration on the top. This is a Mobil State G No. 1 located in Section 24, location "B". It responded to a rate of 46 barrels of oil per day in June of 1969 and declined to three barrels per day in June of 1970. The water is up to 53 barrels per day at the present time.

On Figure No. 22, this was another well that was just barely beginning to respond and I was searching in the expansion area for other wells that experienced a two-way push and had shown some response, but I did not find any because some of the high spot elements were not developed in the San Andres zone yet. The example of this is in Section 26, Location "B" and in Section 26, Location "F". We see that referring to Exhibit No. 6, that there are no San Andres wells yet

in these two five-spot elements.

Q Have you been able to draw any conclusions in your study of these charts?

A Yes. These curves demonstrate that response to injection at the producing wells will occur in about one to two years characterized by large volumes of water production which begins at the first oil response or soon thereafter. The water rates reach 200 to 300 barrels per day very often. In one instance, a well produced more than 400 barrels per day in this expansion area. The expansion area, of course, is more interesting to me because it was closer to Marathon's tracts. The peak oil rates from these wells are short lived. They experience a sharp decline in oil production accompanied by rapidly increasing water rates.

I confirm that the waterflood reserves from the closed five-spot elements are going to be substantially less than primary oil recovery, something like 50 percent of primary reserve.

As you would expect, wells located outside of the five-spot element having a two-well push or one-well push and in some instances a three-well push don't respond nearly as well as the center producing wells. In fact, these are particularly very poor performers.

I don't see anything in the performance of these wells that would demonstrate that there is much difference in the permeability distribution characteristics from the pilot area on down through the wells that I have production data on with response to the waterflood. In fact, some of these wells in the expansion area which is closer to Marathon's lease seem to produce higher water cuts and certainly larger daily volumes of water.

I think these are about the main general conclusions that I have arrived at from this review of the waterflood performance to date.

Q Have you been able to draw any conclusion as to the probability of water saturation as a result of Mobil's proposed injection underneath the Marathon-McAllister Lease?

A Yes.

Q Especially under the San Andres or the lower San Andres?

A Yes. Referring to Marathon's Exhibit No. 6, we see that in the northwest quarter of Section 25 which is part of Mobil's Bridges State Lease adjoins Marathon's tract on the north, there are no producing wells in the San Andres at this time. Of course, we have established

that there is no production from the upper San Andres under Marathon's Lease, the McAllister State. There is a production from the San Andres to the south of Marathon's Lease and, generally speaking, both zones produce south of Marathon's Lease. The upper San Andres and the lower.

In considering Mobil's Well No. 13, which is now the proposed injection well, it is not shown this way on Marathon's Exhibit No. 6 because we weren't aware that this proposal would be made. In considering the pressure under the -- in this area, we have a recently measured pressure under Marathon's Lease in the Grayburg of about 750 P.S.I., and I am sure it is not greater in the upper San Andres and probably much less. Since there is no production under Mobil's tract to the north in the northwest quarter of Section 25, probably the pressure has tended to equalize in time between these two Leases. Since Mobil is starting injection in Section 25 in the northeast corner of Section 26 at Wells 32 and 38, I would expect the pressure to increase under Mobil's quarter section of the Marathon tract. This establishes a pressure gradient from Marathon's -- not from Marathon's -- but from Mobil's Lease through Marathon's Lease decreasing

further into the area south of Marathon's lease.

If Mobil starts injection through Well No. 13, I believe that the water will move in all directions from this well initially. It will go toward Marathon's Lease just as it will toward, to the north and west and east, toward Mobil's producing wells. If anything, the pressure gradient favors its movement to the south. The water will not move as a sharp front. It will advance more rapidly in the permeable strata and probably from the performance that I have discussed just previously, it will cause a substantial increase in water saturation under Marathon's Lease, particularly under Well No. 4. In time, I believe it will get to Well No. 3, particularly in the more permeable strata.

Q Mr. Paxton, just a point of clarification, I believe that you said that the pressure Marathon is now experiencing in the lower San Andres was a maximum of 700. At what pressure does Mobil intend to inject into Wells 13 and 14, the ones that bound Marathon's Lease?

A Mobil's injection pressure will typically be in excess of 200 P.S.I. and the bottom hole injection pressure would then be approaching 4000 P.S.I. rather

than the 3800 P.S.I. that was previously established. This certainly establishes a higher pressure gradient from the injection Well No. 13 toward Marathon's Lease. Sorry I failed to point this out.

Q Now, turning your attention to Wells 25 and 13 which Mobil has testified to the fact that they plan to seal off these wells so as to inject on the upper San Andres. What is your opinion of the effectiveness of their proposed sealing-off procedure?

A Knowing that the pressure in the San Andres is probably in the neighborhood of 750 P.S.I. or less and that their bottom hole injection pressure will be 3800 P.S.I. or thereabouts, I am concerned about the differential pressure between these two zones which we have considered as two reservoirs for the purpose of this Hearing.

This Well No. 13 which is in the injection Application at this time I believe is shown on Marathon's Exhibit No. 4. I would like to look at the log on this well. It was originally drilled to a T.D. at 4763 feet in October of 1938. The well was shot with 320 quarts of nitroglycerine from 4390 to 4550 feet, and if you look at the log, there is a caliper log track that shows a

big hole from about just above 4400 feet to about 4595 feet. This is a very large hole. Then this well was deepened to a T.D. of 6800 feet.

I am going to refer you to Mobil's diagrammatic sketch on this well. I don't have the Exhibit number. Can somebody tell me what that exhibit is?

A VOICE: 13.

A (Continuing) Exhibit No. 13. It is the next to the last page in this group of pictures. This well was drilled to 6800 feet or deepened to 6800 feet and a liner was run to that depth, and the liner was cemented. Then, the top of the liner was cemented with 15 sacks. I am concerned about the evidence that there would be a cement coverage across the San Andres formation. In view of the differential pressure between the upper zone in the San Andres and the lower San Andres, I am also concerned about the quality of the cement behind the pipe in this well. I think there is a good possibility that channeling could occur in a well such as this since this cement job had to come back up 2000 feet around this liner.

With regard to Well No. 25, it shows on Marathon's Exhibit No. 5 which is another Mobil injection

well. This well was drilled originally to a T.D. of 4750 feet and completed in the San Andres formation in February of 1939. It was an open hole from 4200 feet to T.D. You can see on this Exhibit with notes under the log of the Well No. 25, there is a remedial work note that came out in September of this year that Mobil would plan to set a whip-stock and drill around the junk in the hole in the old T.D. of 4750 feet. I understand that this work has been done. If they set a whip-stock to drill around junk, they have drilled another hole at a slight angle beside this one because that is what a whip-stock is for.

In this case I am quite concerned about their ability to effectively plug back both of these zones to the depth of 5600 feet as they have indicated that they intended to do.

Q Now, turning your attention back to Marathon's Exhibit No. 6, what is your opinion of the effect on the Marathon Lease especially their Well No. 2 will feel from the injection of Mobil's Well No. 14?

A With regard to injection in Well No. 14, so long as Mobil's Well No. 11, immediately to the west of No. 14 and Texaco's Well No. 3 -- I am sorry, No. 11 is

not a producer in the San Andres -- I am assuming that they will have a producer at approximately the location of No. 11 or thereabouts -- and Texaco's Well No. 3 south of Mobil's Well No. 14, we will not suffer damage from injection into Well No. 14, however, we have no control over Mobil's location east -- I am sorry -- west of 14 or Texaco's Well No. 3 in the event of a failure of either of these wells. We could suffer some water encroachment under our Lease from No. 14. This is the substance of our objection to Well No. 14 as an upper San Andres injection well.

Q Did Mobil ever ask Marathon to cooperate in a waterflood expansion project?

A Yes. Mobil wrote us a letter in August of 1969 and invited Marathon to cooperate with them in this program by conversion of Wells 2 and 5 on Marathon's McAllister State Lease, however, No. 5 was not a San Andres well and we assumed that they intended that we convert Well No. 3. Marathon declined for a number of reasons. We had three top allowable wells and one good well on our Lease. Our primary efficiency we could see was very excellent and we were not sure that a waterflood program now would increase the ultimate

recovery of this lease. Another reason is that waterflooding at this time interrupts our plan for depletion of this Lease which was covered in Mr. Zeman's testimony yesterday. In this cooperation, Marathon would have been required to convert two good wells to production -- to injection -- and these would have been No. 2 and No. 3 with a substantial loss of income, substantial expenditures would have been required for the conversion of the two injection wells, installation of water lines, larger pumping equipment and the purchase of water. Another thing, referring to Exhibit No. 6 again, assuming that No. 2 and No. 3 on Marathon's McAllister State Lease were injection wells, the No. 4 well would have been the only center five-spot producer benefiting from approximately an 80-acre five-spot element and part of this element was located in an area of the reservoir that was not as good as that under Marathon's.

Well No. 1 would have been located where it would have had only push from two wells and as we have seen, this situation is not good. Wells of this nature perform very poorly under the waterflood program, so we would have benefited from the waterflood reserve under maybe 120 acres rather than the 160 that we have

under our Lease. We had no way to offer Getty, who is the offset operator to the south, or Texaco to the east an opportunity to cooperate with us since we did not have a water supply to offer them, and in view of the good performance on Getty's Lease and generally wells south of Marathon's Lease, we would not have expected cooperation in that direction.

We feel that at such time when secondary recovery is appropriate in this area where the small tracts are that the operators will join in a study to determine the feasibility of the waterflood program, and that if waterflooding is attractive, that they will unify where we will have the flexibility of operation offered in a large unit area. The oil recovery would certainly be better than under the cooperative situation and the cost will be less. No doubt, it will devise the most efficient and equitable program possible under a unified program.

Q Mr. Paxton, do you have anything further to offer?

A I believe this concludes my coverage of these exhibits except for the fact that we don't enjoy offset injection wells where we have very good primary

performance because we have no control if something goes wrong which is a good possibility in this case considering the condition of Mobil's injection Wells 13 and 25.

Ordinarily the wells outside of the waterflood area don't enjoy good response. You have no flexibility regarding allowables and no way of obtaining increased allowables should you realize any help from an injection program.

I feel that we should have some safeguard from preventing injection offsetting us in this case.

Q This is why you again reiterate your objection to their proposal as modified to inject into Wells 25 and 13 and 14?

A Yes, sir.

MR. LOPEZ: At this time I would like to offer Marathon's Exhibits 6 and 7 into evidence.

MR. PORTER: If there are no objections, Exhibits 5 and 6 will be admitted.

MR. LOPEZ: 6 and 7.

MR. PORTER: Yes, 6 and 7.

(Whereupon, Marathon's Exhibits Nos. 6 and 7 were offered and admitted in evidence.)

MR. LOPEZ: This concludes the testimony of this witness.

MR. PORTER: Mr. Sperling, do you have any questions?

MR. SPERLING: Yes.

CROSS EXAMINATION

BY MR. SPERLING:

Q Mr. Paxton, you expressed general concern, I believe, as to the effect upon Marathon of the injection by Mobil into Wells 13 and 25, but I don't believe you explained the actual basis of that concern in view of the fact in your statement that the Marathon wells were not producing from the upper San Andres?

A Well, I am sorry. I think there is a possibility here that the seal between the upper San Andres and lower San Andres would not be effective because of the mechanical condition of these two wells.

Q Do you mean the mechanical condition of 13 and 25?

A 13 and 25, yes, I think there is a good possibility that water would enter the lower San Andres formation and this is a zone that we, of course, are producing from and this is the reason for my concern about these two wells, as far as the lower San Andres is concerned. There are other reasons for objecting so

far as the upper San Andres is concerned.

Q Well, what would be your suggestion as to how to handle the mechanical completion of those wells to insure against them?

A I don't think we should suggest to Mobil how they complete these two wells for injection. I think we should be protected from injection in the Grayburg-San Andres.

Q Well, let me put it this way: If these wells were your wells, what would you do?

A I have not considered this matter. I think the No. 25, assuming that there are two holes or in practice there are two holes, I think it would be unlikely that a person could remedy this situation with junk in one of them. I don't know the details of the whip-stock job. I don't know where the whip-stock was set. I think the problem would occur below the whip-stock point.

Q Well, your concern, then, following your explanation to means that it is based primarily on possibilities?

A Yes, sir. In fact, in this case, I think a probability due to the differential of pressure between

the two zones.

Q You don't have any pressure information on the upper San Andres, do you?

A No. I think the pressure information that we have on the upper San Andres alone is probably -- there is probably not any -- it has been produced along with the lower zone, so I am assuming that the pressure is probably similar in the two zones; if anything, less than the lower. That is, the upper zone would be less than the lower because of the different elevations of the two. We know that the original pressure was somewhere in the neighborhood of 1600 plus and the pressure has been depleted to a large extent, we also know by years and years of production from these two zones. The wells are mostly pumping, so I don't think there is any question that the pressure is substantially depleted in both the upper and the lower San Andres.

Q Would you expect the pressure differential of Mobil's Well No. 27 which is shown on your Exhibit 6 and the pressure differential in the San Andres producing Well No. 12 of Mobil's as shown on your Exhibit to be less than the pressure underlying Marathon's Lease?

A Well No. 27 and -- where is Well No. 12?

Q Well No. 12 is in the southeast corner of Section 26.

A Oh, I see. Would I expect the differential to be --

Q (Interrupting) Well, would you expect the pressure to be lower in the vicinity of Wells 12 and 27 and thus include a producing well in the vicinity of No. 11 which is in Section 25 to the north of Marathon's Lease; would you expect the pressure to be lower in the vicinity of those producing wells than on Marathon's Lease?

A In the case of Well No. 12, I would expect it to be lower. No. 27 is indicated to be producing from some other horizon. I wouldn't expect it to be different appreciably from Marathon's pressure. The pressure in the vicinity of Well No. 11 would probably also be similar to the pressure under Marathon's Lease because of the injections to the north. It might even be higher than under Marathon's Lease.

Q You did indicated that you expected a producing San Andres well to be drilled in that location or in the vicinity of that location?

A Yes, sir.

Q And the Texaco No. 3 Well also in Section 25 is producing from the San Andres, is it not?

A That's the indication that I have here.

Q Would you expect the pressure to be lower in the area of that upper San Andres producing well than on the Marathon Lease?

A I don't know that that is an upper San Andres producing well. It is more than likely in both zones.

Q Well, the upper San Andres is open?

A Yes, sir. Yes, I would expect it to be lower than Well No. 22 as far as the San Andres is concerned because of production at that point. The drainage should be in that direction.

Q Right. So, in fact, assuming of course the completion of the producing well in the upper San Andres in the vicinity of 11 -- Mobil has indicated 11 Well --

A (Interrupting) All right.

Q And the 14 Well. Now, that is an injection. And the Texaco No. 3 Well, and the Mobil No. 12 Well. you have the Marathon Lease bracketed with areas of lower pressure, don't you?

A I am sorry. There is not a producing well at the location of No. 11.

Q I know, but you stated that you assumed that a producing well would be drilled there, didn't you?

A Yes, sir, but at this time it is not.

Q I am making that same assumption, and if that assumption is correct, then, don't you have the Marathon Lease bracketed by wells which are open in the upper San Andres; whereas, the Marathon wells are not open in the upper San Andres?

A There are wells all the way around the Marathon Lease except to the north side producing from the upper San Andres.

Q And you expect the pressure, as a result of the San Andres being open, to be lower in those areas than on the Marathon Lease?

A Yes, sir.

Q Well, then, how do you reach the conclusion that until such time as the Marathon-Upper San Andres is open that all of the water is going to go over on Marathon?

A I didn't say "all of the water." The injection --

Q (Interrupting) Enough to water them out, then?

A Injection in Well No. 13 and Well No. 25 will create a pressure higher at these two wells. We are talking about a pressure level of 3800 P.S.I. This would

give us some 3000 pounds of differential pressure from these injection wells toward Marathon's Lease. I think we have all agreed that movement of fluid would be from the high pressure to the low pressure points.

Q Do you know whether the Texaco No. 3 Well is a good well?

A I can look up that right quickly, I believe. Texaco's "Q" No. 3 during June of this year averaged 25 barrels of oil per day.

Q Are you aware of any objection from Texaco to the injection of water in this Well No. 13?

A No, I haven't discussed this with Texaco.

Q Mr. Paxton, you made reference, I believe, to Mr. Kelly's testimony and your acceptance of that testimony concerning the bottom hole pressures in the water injection wells in the neighborhood of 3800 P.S.I.?

A Yes, sir.

Q To what point beyond the injection well would you anticipate that pressure would be maintained?

A Well, that pressure profile would decline from the injection well outward in all directions in the case of Wells Nos. 13 and No. 25 when they are initially put

on injection.

Q At what rate would it decline?

A Well, sir, I cannot tell you this. Perhaps if Mobil had some pressure fall-off tests, we could analyze these things.

Q Well, could you give an opinion as to what you think the pressure would be assuming 3800 pounds of bottom hole pressure in Well No. 13 at the lease line between Marathon and Mobil?

A No, it would be between 3800 pounds and whatever the reservoir pressure is under, say, Well No. 4 on Marathon's Lease, and we don't know what that is except that we know that it is substantially depleted from the initial pressure.

Q You wouldn't give an opinion as to whether it might have declined to 1500 pounds or 900 pounds?

A Yes, sir. As I stated, we think the pressure in the San Andres horizon is about 750 P.S.I. under Marathon's Lease.

While we are talking about No. 13, injection into that well, the water advanced from that well in all directions. Their flow to the north will be resisted to some extent when they encounter influence from the

other two injection wells, No. 105 and 32, and this will tend to restrict the flow to the north. The same thing applies to Well No. 25.

Q Do you expect that resistance to be minimized by the withdrawal of fluids from producing wells to the south?

A To the south?

Q Yes.

A No.

Q And north?

A The producing wells to the north is between the -- I mean the injection well is between the producing well to the north and the low pressure area to the south.

Q What low pressure area to the south?

A Well, under Marathon's Lease and on the end of those tracts adjoining Marathon to the south.

I have said that burrow (sic) of magnitude the pressure is about 750 P.S.I. in this area or less.

Q Do you have any pressures to the south, measured pressures?

A No, sir.

Q That you are aware of?

A No, sir.

Q The Getty Wells 1, 2, 3 and 4 are producing from the San Andres, is that not true?

A Yes, sir.

Q Mr. Paxton, I want to pursue a little bit farther your statement concerning the resistance afforded by injection wells to the north of the Marathon Lease which I believe are Wells 105 and 32. The statement you made, I believe, was that injection into Well 13 would encounter resistance as a result of injection into those two wells to the north?

A Yes, sir.

Q And I believe you said that you would expect that to be counteracted to some extent by the producing wells which are served by those two injection wells. Now, do you have an opinion as to whether or not or to what order of magnitude there would be in the resistance offered by injection into Wells 105 and 32 as compared to the resistance offered by the pressure underlying the Marathon Lease where there is no upper San Andres production?

A Possibly to clarify, injection will be occurring in all of Wells 13, 32 and 105 simultaneously. Water will advance radially from these three injection wells

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assuming that there are no directional permeability problems in the reservoir. At some time the water advanced from each of Wells Nos. 32 and 38 will come in contact with that from No. 13. This is called interference between injection wells and this will tend to resist the injection into No. 13 and through the reservoir from Well No. 13. In addition to that, as the water advances through the reservoir the resistance flow increases.

Q I think as a part of my question I asked you to make a comparison, if you could, as between the extent of the resistance which you have stated is likely to occur at some point with water injected into 13 when it meets water injected in 32 and 105. The comparison I wanted you to make was the magnitude between that resistance and the resistance already present by reason of the fact that there is no production on the Marathon Lease in the upper San Andres.

A The point that I hoped to make here was that there was some additional resistance to the north that would tend to cause water to flow toward the south in addition to the pressure differential to the south which is quite substantial; 3800 P.S.I. at the injection well and 700 P.S.I. in the reservoir to the south.

Q Well, do you have an opinion as to whether or not that pressure differential that you are speaking of now would be minimized by the reduction of the injection rate into Well No. 13?

A A reduction in injection rate in Well No. 13 would reduce the pressure at No. 13. It reduce the flow in all directions from that well.

Q Do you have a recommendation as to the injection rate into Well No. 13?

A No, sir. I am objecting to the injection into Well No. 13.

Q At all?

A Yes, sir.

MR. PORTER: I think his recommendation is zero.

BY MR. SPERLING:

Q You've got to agree that a reduced injection rate into that well would minimize the problem.

A I am not sure what we are talking about "reduced injection rate." I understand that the injection rate will probably start out at 1000 barrels per day and be reduced to 500 barrels per day shortly.

Q Well, "injection rate" is a word of art in your business?

A Is a word of what?

Q Art. I mean it does have a definite meaning.
It relates to volume of water produced through an
injection well?

A Yes, sir.

Q I am asking you if you agree that a reduced
rate of injection into Well No. 13 would minimize the
problem that you foresee insofar as the effect of
injection on that well on the Marathon Lease?

A Yes, it would reduce the water's advance on
Marathon's Lease, certainly.

Q Now, just one more short -- I hope -- series
of questions with reference to your statement concerning
injection into Well No. 14 which is a diagonal offset
to your Marathon Lease. I believe you stated that you
didn't feel, assuming that there was a producing well
in the vicinity of Well No. 11 on the Bridges Lease
and with the upper San Andres being open under Texaco
Q-3 Well, that there was any great danger to Marathon's
Lease from the injection of that well; is that substan-
tially what you said?

A Yes, I will agree with that. I have observed
that fluid did not move past the row of producing wells

in any large degree.

Q Well, do you see any difference in degree of objection by Marathon to the injection in Well No. 14 as compared to Well No. 13?

A Yes, sir. I have less objection to No. 14 than I do No. 13 and 25.

Q Why is that?

A Because of those -- we can establish that there will be production at the vicinity of Well No. 11 on Mobil's Bridges State Lease and Well No. 3 on Texaco's "Q" Lease. Perhaps I just didn't understand your question.

Q Well, you do have production from a well in the vicinity of 11 Well which I assume will be served by the 14 Well, you stated. Also, production will be experienced as a result of the injection in the 13, won't it; in other words, you have a pressure differential between the well in the vicinity of 11, between injection in 13 the same as you do in 14, correct?

A I don't follow you. There is not a row of producing wells between No. 13 and 25 and our Well No. 14 -- No. 4, I am sorry -- our Well No. 4.

Q I am talking now about 11, 13 and 14.

A All right.

Q You stated that you had no objection, no substantial objection to injection into 14 in view of the fact that there was going to be a producing well in the vicinity of 11?

A Yes, sir. We have no control over this 11 and 3. That is our objection in this regard.

Q My point is that injection into 13 is going to result in production from 11 too as well as injection into 14, isn't it?

A Yes, I would expect that No. 11 would respond from injection into No. 13, however, production from No. 11 and Marathon's No. 4 only protects to some extent Well No. 2. I have shown -- going back to my Exhibit No. 7 -- there is a group of wells in there of the configuration that we are speaking of here. Let me refer you to Figure No. 11. This has Well No. 31 as a producing well and we can liken that to Marathon's Well No. 2. Of course, you see an injection well in that configuration. Then there are two producing wells in this pattern, and if you will notice the effect on -- well, I will liken these two producing wells to Well No. 11 on Mobil's Bridges State and Texaco's No. 3 on the "Q" Lease, State "Q" Lease, I believe that is, and Well No. 31

to our No. 2. There is not much effect this way with this configuration, and this is what we have between No. 14 and No. 2. Now, there is no such configuration between Well No. 13 and Well No. 4.

Q Isn't it true that your Figure 11 shows that there was about two years before there was any response as a result of injection into that well, and then that the pressure increase was not substantial?

A Well, I don't have any pressure on here.

Q Is there a comparison between production and pressure in a waterflood?

A Comparison between production and pressure?

Q Yes. Pressure pushes the oil, doesn't it, with that pressure generated under water?

A It pushes water and oil.

Q Well, is there a relationship, then, between pressure and production?

A Perhaps you are asking me why in this configuration, Well No. 31 did not respond too appreciably to their injection?

Q Yes.

A And my answer to this is because there is a withdrawal with these other two producing wells on this

configuration. There is not much fluid that will pass a row of producing wells which are indicated here by wells that are shown and that are not numbered. I believe that is what is to be expected.

Q Doesn't that support Mr. Kelly's conclusion yesterday that there would be very little encroachment upon the Marathon Lease?

A No, sir. I think we have to consider the configuration of the injection and producing wells in this matter. I think the injection into Well No. 13 and Well No. 25 is going to advance in the reservoir very similar to the way it did in --

Q (Interrupting) Would your conclusion be the same if there is a producing well in the vicinity of Well No. 27 which is diagonal offset to Marathon?

A It would be a center five-spot?

Q Yes.

A Yes, that's true. The advance of fluids toward No. 27 would not be appreciably different from the advance of the fluids toward Well No. 4 on Marathon's Lease. The configuration is identical.

Q With No. 4 not being open to the upper San Andres?

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A Well, the pressure in the reservoir is low under Marathon's Lease at Well No. 4, much less than it is at these two injection wells, 13 and 25.

Q Would you expect oil to be pushed in advance of the water as a result of the injection into Wells 13 and 25?

A Yes, oil will be pushed in advance.

Q Into the vicinity of Well No. 4?

A Now, wait a minute. I would like to say that the water advance will be proceeded by an advance in oil and that the advance will be predominately in the more permeable strata, so we are not talking about a sharp front. We are talking about a movement of water and oil in the reservoir.

Q Do you believe that any resaturation of upper San Andres with oil will occur as a result of injection of wells into 13 and 25?

A Resaturation?

Q Yes.

A It will resaturate the type of rock with oil where there is a gas saturation as the water advances.

Q You don't think will occur in the permeable sections, pay sections; you don't think there will be

saturation there too as well as the denser rock?

A The oil will -- from the more permeable rock will move into the tighter rock replacing the gas saturation and will not be displaced until the pressure is increased in the reservoir and the water advances in the lower permeable strata. This is apparently one of the problems in this waterflood. I think that it is pressure sensitive from examining the performance of Mobil's five-spot. The production response improved when they did raise the pressure and injection rate. I believe this is the reason that this happened.

Q Are you saying, then, that the picture changes insofar as the permeability pattern is concerned, changes markedly in this area?

A I don't have any information about the permeability in the different areas of the reservoir. My review of these producing wells does not indicate that there is any marked difference in the permeability from one area to another.

Q Well, then, you are not saying that there is a high permeability streak insofar as the Marathon Lease is concerned?

A Oh, I think in all of these reservoirs there

is permeability variations that can be quite substantial from very tight rock on the order of a tenth of a millidarcy permeability up to even 100 millidarcy of permeability. I don't have any core data in this area, but this is characteristic of carbonate reservoirs that the permeability does vary considerably.

Q But you don't have any specific information with reference to Marathon in that regard; you are just assuming that from --

A (Interrupting) I don't have to assume this, I don't think. It is a characteristic that we don't find exceptions to in our reservoirs in this area.

Q Then I take it you don't agree with the permeability streaks indicated on Mobil's Exhibit as being present in the northern end of the field as distinguished from the southern end?

A I don't challenge the permeability streak in the north end of the field. I don't see evidence from my study that it is or is not farther on to the south. As we move south from the pilot area toward Marathon's Leases, I think I have shown that the water break-through was more substantial than it was in the pilot area.

MR. SPERLING: That's all I have.

MR. PORTER: Does anyone else have any questions of Mr. Paxton?

He may be excused.

(Witness dismissed.)

MR. LOPEZ: Mr. Porter, I believe that concludes our case.

MR. PORTER: Mr. Kellahin, I believe you indicated that you have a witness?

MR. KELLAHIN: Yes, sir.

VICTOR T. LYON

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A Victor T. Lyon.

Q By whom are you employed and in what position, Mr. Lyon?

A I am employed by Continental Oil Company as Conservation Coordinator in the Hobbs Division Office located in Hobbs, New Mexico.

Q Are you a Petroleum Engineer?

A Yes, sir, I am.

Q Have you testified before the Oil Conservation Commission and made your qualifications a matter of record?

A Yes, I have.

Q Mr. Lyon, you have made a study of the area involved in the Application that is presently before this Commission?

A I have made a general study and am generally familiar with our State H-35 Lease in the immediately surrounding area, and I am very generally familiar with the Vacuum Pool.

Q You testified in previous Hearings in this case, did you not?

A Yes, I did.

MR. KELLAHIN: Are the witness' qualifications admitted?

MR. PORTER: Yes.

BY MR. KELLAHIN:

Q Mr. Lyon, referring to what has been marked as Continental's Exhibit No. 1, would you identify that Exhibit?

A Yes, sir. Exhibit No. 1 is a location and ownership plot showing approximately in the center, Continental Oil Company's State H-35 Lease. The Lease

is shown outlined in red and consists of the NE $\frac{1}{4}$ and the E $\frac{1}{2}$ of the NW $\frac{1}{4}$ of Section 35, Township 17 South, Range 34 East. It also shows surrounding Leases and wells and the ownership and the formations on which they are completed by a letter symbol, the legend for which appears in the lower left-hand corner of the Exhibit. Mobil-Bridges Lease or a portion of it is shown outlined in the green color. Continental's State H-35 Lease has seven wells which are producing from the Grayburg-San Andres Pool in the Vacuum Field and it also has wells producing in Glorieta, Wolfcamp and the Abo, and these wells are shown on the plat.

Q Now, referring to what has been marked as Exhibit No. 2, can you identify that Exhibit?

A Exhibit No. 2 is a copy of a portion of the Gamma Ray Resistivity Log on the State H-35 No. A which is a twin well to the State H-35 No. 2. They are both located in unit A of Section 35. We did not have a log of Well No. 2 and consequently we have used the log on Well No. "A". We have superimposed on the log the casing seat and the total depth and the resulting open-hole interval in Well No. 2. As you can see, there is an open-hole interval of over 500 feet. We have also

indicated on the log the top of the San Andres, the base of the Lovington Sand and the top of what we have designated the 9th Massive zone.

Q Now is this particular well open in what we have referred to as the upper San Andres and the lower San Andres?

A It is open in the upper San Andres and it is also open in the lower San Andres and has penetrated to some extent the 9th Massive zone.

Q So this well would be affected by injection in the upper San Andres assuming the water would reach it, is that correct?

A Yes, it would.

Q I refer you to what has been marked as Exhibit No. 3. Would you identify that Exhibit?

A Exhibit No. 3 is a copy of a portion of the Gamma Ray Log on the State H-35 No. 7 which is a twin well to State H-35 No. 3, both of which are located in Unit B of Section 35. Here again we have shown superimposed on the log, the open-hole interval resulting from the depth that the casing is set to the total depth of the well. It also has a very large open-hole interval and is open both in the upper and lower

San Andres.

Q Now, referring to what has been marked as Exhibit No. 4. Would you identify that Exhibit?

A Mr. Kellahin, let me go back and put in some additional testimony on Exhibits 2 and 3, please?

Q Yes, sir.

A We also show production data on the two wells. I am going back to Exhibit 2 which is the log of State H-35 No. 8 which is a twin well to State H-35 No. 2. The latest test in State H-35 No. 2 which was taken in April was 60 barrels of oil per day and no water with a gas-oil ratio of 1733. It has accumulative production of 469,477 barrels. State H-35 No. 8 is producing 20 barrels of oil and 6 barrels of water from the Glorieta formation.

Now, going back to No. 3 which is the log of No. 7, a twin well to No. 3. Well No. 3 tested in April, 31 barrels of oil and no water, a gas-oil ratio of 1806 and has accumulative production of 446,000. This is to January 1st, 1970. Twin Well No. 7 is producing down-hole co-mingle from the Abo and Wolfcamp and in July, tested 18 barrels of oil and no water per day.

Q Now, go to Exhibit No. 4.

A Exhibit No. 4 is a copy of the Gamma Ray Sonic Log of State H-35 No. 11 which is a twin well to State H-35 No. 6, both of which are located in Unit C of Section 35. We have superimposed on the log, the open-hole interval in No. 6. No. 6 is producing from the upper San Andres and has barely penetrated the top of what we designate the 9th zone, but has not penetrated the top of the 9th Massive zone. In April, Well No. 6 produced 12 barrels of oil per day and 4 barrels of water with a gas-oil ratio of 1141. It has produced approximately 345,000 barrels of oil, cumulative. The between well, No. 11 was junked and abandoned in 1964.

Q Now, referring to Continental's Exhibit No. 5, would you identify that Exhibit?

A Exhibit No. 5 has two pages to it. Page No. 1 shows a copy of a portion of the Gamma Ray Neutron log on State H-35 No. 4. Page 2 shows the data on this well. There is no twin well to this well, and we do have a log on the well so that we can show the actual log on the well. The open-hole interval is indicated by the placement of the symbol representing the casing shoe at approximately 4153 and the total depth is 4708. As shown, the well has produced from the upper San Andres

and does not appear to have penetrated the 9th Massive zone. This well has been stimulated twice. In 1962 it was frac'd with 20,000 gallons and in 1969 we attempted a blast-frac which is a relatively new stimulation method involving an explosive. Both stimulation attempts were unsuccessful. It was last tested in December of 1969 for zero barrels of oil production, 15 barrels of water per day. The well is temporarily shut in.

Q What is the cumulative production on that well?

A I don't seem to have it on this. Yes, I do. Cumulative production was 377,518 barrels as of January 1st, 1970.

Q Now, referring you to what has been marked as Continental's Exhibit No. 6, would you identify that Exhibit?

A Exhibit No. 6 is a copy of the Gamma Ray Sonic in Well No. 10 which is a twin well to No. 5, both of which are located in Unit G of Section 35. The open-hole interval in No. 5 is shown as we have shown on the other exhibits. It is quite a large open-hole interval. No. 5 penetrated to a little bit into the

9th Massive zone. It is also open in the San Andres, of course. This is a very interesting situation. This is the situation which we described to the Commission, to the Examiner at the last Hearing. The work which we had proposed at that time has been completed. Well No. 10 has been recompleted in the lower Massive. It was previously a Blinebry well which was non-commercial. We plugged the well back and perforated additional sections lower in the 9th Massive zone. The two wells together are now producing top allowable, 70 barrels per day. Well No. 10 tested on August 13, 41 barrels per day. No. 1 in April tested 27 barrels of oil per day.

Q Now, this recompletion in the deeper zone, is it comparable to the recompletions that were testified to by Marathon's witness?

A Yes, sir. As a matter of fact, Marathon's work helped to stimulate and help us in the planning of this job. At the last Hearing, we said we felt that we had additional reserves in the 9th Massive zone and I believe that this work has positively demonstrated that we do have additional reserves in that zone.

Q You have given testimony about these various zones, Mr. Lyon, the upper San Andres, the lower

San Andres and this 9th Massive zone which you are now referring to. Those are all one common pool, are they not, as defined by this Commission?

A Yes, they are.

Q They are in the Grayburg-San Andres Pool?

A Yes, sir, it includes the Grayburg also.

Q But none of the wells we are dealing with here are completed in the Grayburg, right?

A The Grayburg is open, but I do not believe it is contributing production.

Q Now, referring to what has been marked as Exhibit No. 7, would you identify that Exhibit?

A Exhibit No. 7 is a copy of a portion of the Gamma Ray Sonic log on State H-35 No. 12 which is a twin well to No. 1. Again, we have shown superimposed on the log the open-hole interval in Well No. 1. Both of these wells are located in Unit H of Section 35. No. 1, last tested in April produced 22 barrels of oil, 4 barrels of water per day with a gas-oil ratio of 3217. It has a cumulative production of 454,433 barrels as of January 1st. Well No. 12, last tested in June, 72 barrels of oil per day, 28 barrels of water, producing from the Glorieta formation. This location has

another well, Well No. 9 which tested in July, 41 barrels of oil per day, 61 barrels of water per day from the Abo formation.

Q Mr. Lyon, will you turn to Continental's Exhibit No. 8 and identify that Exhibit, please?

A Exhibit No. 8 is a very simplified cross-section running through our wells and nearby wells. If you look at the right side of the exhibit there is a plat showing the trace of the cross-section. From left to right, the cross-section goes from Phillips' Mable No. 3 eastward through the lower tier of wells on Continental State H-35 Lease over to Texaco State-O No. 1. Then, north to Getty State-BA No. 3, and then west through the northern row of wells on Continental State H-35 Lease, and then northeast to Mobil-Bridges No. 15, then eastward to Mobil-Bridges No. 12 and on eastward to Marathon's McAllister No. 3. We have simply shown on this a simplified cross-section, the completion intervals in the wells.

Q How was this information determined for the purpose of preparing this Exhibit?

A We have prepared this on the basis of logs and scout tickets and information which was available

in our files.

Q Go ahead with your discussion of the Exhibit.

A These wells are arranged on a datum so that the effect of structure is shown. We have connected the tops of the San Andres, the base of the Lovington Sand and the top of the 9th Massive zone through all of the wells. Now, these are the same points which are shown on Exhibits 2, 3, 4, 5, 6 and 7. So that the points shown on those exhibits correlative to the tops of these zones which we have shown on this cross-section.

At the far righthand side of the cross-section itself in the Marathon-McAllister No. 3, you can see the recompletion interval of the well in what we designate the 9th Massive zone. This well has -- it is still, I believe, producing top allowable production. The Mobil-Bridges No. 12 and also No. 15 have both penetrated this zone and it is our understanding, based on what Mobil has told us and has told the Commission at this Hearing, that these wells will be plugged back at the lower pay which I presume would be at least up to the base of the Lovington Sand.

Going to the left of the Exhibit again, you

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will note that State H-35 No. 6 has not penetrated the top of the 9th Massive. We believe that this location, this well has excellent recompletion or remedial prospects by deepening it approximately 100 feet to get into the 9th Massive zone.

Going to the left again, State H-35 No. 3 has topped the 9th Massive, but we believe that additional penetration will give us very likely additional reserves in that zone.

State H-35 No. 2 is the well which produces approximately 60 barrels per day and we believe that it has penetrated enough into the 9th Massive to demonstrate why its production has held up so well.

Q Your No. 5 has indicated you have penetrated this 9th Massive zone?

A Yes, sir.

Q Is that correct?

A Yes, sir. Well No. 5 is located the third well from the left. It is the twin well to No. 10 and you can see on the cross-section a comparison of the wells, that the fact that we opened up additional pay lower into the 9th Massive we believe explains why we were able to get additional oil out of the zone to the point that the wells

producing together are producing at top allowable rates. We believe also that State H-35 No. 4 has possibilities by deepening into the 9th Massive.

The well on the lefthand side of the Exhibit, Phillips-Mable No. 3 is producing in the interval between the top of the San Andres and the base of the Lovington Sand which has been referred to in this Hearing as the upper San Andres. It also is producing in the top of the 9th zone, but does not have the 9th Massive open. This well was drilled as a twin to our No. 1 and has recovered considerable additional oil.

Q How long have your wells been producing from the Vacuum Pool?

A Approximately 30 years.

Q Do you anticipate a continued life for these wells?

A Yes, sir. I believe we have several more years of primary producing life. I might point out that the lease certainly is not considered a stripper production, and I don't believe under the Commission's present rules could qualify as a waterflood project even if we were inclined to install a waterflood project at this time.

Q In other words, you are saying it is not at an

advanced stage of depletion, is that correct?

A That is correct.

Q Have you made any comparisons of this pool with any other pool?

A Yes, sir. There are two factors which have brought about the study which we agreed to put into this. First, the lease was producing at virtually top allowable rates until recently when allowables have increased. Also, we have done a great deal of detailed study in the Maljamar Pool which is to the same trend with the Vacuum Pool and we find the formation characteristics to be very very similar.

Q It is also a Grayburg-San Andres Pool?

A Yes, sir, it is. We, incidentally, have done several recompletions in the 9th Massive in that zone and they have been very very successful.

Q Now, Mr. Lyon, the fact that Mobil has at this Hearing proposed to limit its waterflood to the upper San Andres formation, whereas, at the previous Hearing, they were talking about the entire San Andres, does that change your position in any way in opposition to Mobil's proposal?

A No, sir, it does not. If you will look at our

Exhibit 8, with the exception of Phillips' Mabel No. 3 on the extreme lefthand side and our State H-35 No. 10, and Marathon's McAllister No. 3, all of these wells have large open-hole intervals. We have no way to protect ourselves from water intrusion into the wells.

Q How would that water intrude into those wells; could you be specific?

A If water is injected into wells which would offset our wells, I would expect that within a relatively short time we would be having water intrusion in our wells as a result of --

Q (Interrupting) That would be in the upper San Andres. Would that cause damage to the lower San Andres?

A We feel that it could jeopardize our production. Of course, we would want to have the wells producing, those that we can afford to produce. As long as we keep the wells pumped off, we should not have any damage to the lower formations, but we do think the fact that water is pumped into our wells, we would have to pump the water out.

Q That would increase your cost?

A It sure would. It would also probably cause us

to install larger lift capacity.

Q Now, you heard Mr. Kelly's suggestion that Continental should run liners in these wells and shut off its upper formations to keep out the water they are injecting. Do you have any comments on that?

A Well, yes. We would rather not spend the money. We don't see that -- you know, we would like to cooperate and will cooperate at the appropriate time with Mobil -- but this is not the time. If Mobil doesn't inject offsetting our Lease, we don't need to run those lines.

Q In the use of liners in your experience, is the liner always successful in shutting off an upper zone of this nature?

A Not always.

Q Now, referring to what has been marked as Exhibit No. 9, would you identify that Exhibit?

A Yes, sir. Exhibit No. 9 is a tabulation showing the cumulative oil production to January 1st, 1970 and July production of oil, water and gas on Continental's State H-35 wells and on the direct and diagonal offsets. You can see that in most of the wells on this exhibit, there are substantial cumulative

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production. You will also notice that, with the exception of the Mobil wells and a few others, that the current producing rate is quite high. Particularly, I would like you to notice the Phillips' Hale No. 1, 2 and 3. These wells are directly south of our State H-35 Lease. Those wells are producing at a top allowable. I don't believe that Phillips is in any position to even consider a cooperative waterflood at this time, and if we were to place one or more of our wells on injection, our waterflood pattern would not be backed up, just as Mobil's waterflood pattern is not being backed up at the edge of their lease.

Q In your opinion, would it be possible for Mobil to wait until the period when the south has been further depleted for injecting into the wells they are proposing to use for injection?

A Yes, of course, this is possible.

Q Would it result in any substantial loss to Mobil Oil?

A Well, I can understand that this would cause a deferrment of the waterflood oil from their lease. I don't believe that it would cause any substantial loss of oil.

Q In conclusion, Mr. Lyon, is it Continental's

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position that as of today, it is not practical or feasible for them to cooperate with Mobil as has been requested?

A I am sorry, I didn't --

Q (Interrupting) Is Continental in a position today to cooperate in a lease line agreement?

A No.

Q In your opinion, would the utilization of the offsetting wells for injection as proposed by Mobil cause any damage to Continental?

A Yes, sir, we think so. We think that the injection of water into offset wells would jeopardize the primary reserves which we have under our lease. We think that in addition it would jeopardize secondary recovery prospects which we have on our lease.

Q Do you have any conclusions to state, Mr. Lyon?

A Well, I would like to summarize our position to the effect that we recognize that Mobil has a problem. They are ready to waterflood their lease, and we have been in this position and are in this position in many places. We would like to be able to cooperate with them, but because of the primary producing rates which we have

on our lease, we cannot cooperate with them. We do not desire to interfere with their waterflood project so long as it does not endanger our primary reserves or our secondary reserves prospects. As soon as we can complete the evaluation of our reserves and our situation, we will attempt to work with Mobil to find some mutually satisfactory method of recovering these reserves, but until we have done this, we must renew our objection to their placing wells offsetting our lease or converting wells directly offsetting our lease to injection.

Also, I might point out that we have a small lease, 240 acres, 6 wells or 6 locations. Mobil has quite a large lease. Since it is obvious that Phillips to the south of us is not anywhere near ready to flood, we are not ready to flood, Mobil is ready to flood, there has got to be somewhere a place where the injection wells stop. There has got to be a change in pattern. I might refer to the exhibits up here on the board to try to illustrate what we feel that Mobil is trying to do to us. If you will look at Exhibit No. 4, the red area over there is what you might term the area of inefficiency. This area is not going to be flooded as efficiently as it is where the producing wells are

completely enclosed.

If you look over here on Exhibit No. 6, they have shown the wells that have a three-way push in a different color and then the wells that have a one or two-way push and I am differentiating here to show what Mr. Kelly referred to as a one-way push in that there are two-way pushes in there also. But what Mobil is asking to do is to move this area, the yellow area down toward our lease, and if you will refer to the other Exhibit No. 7, I believe it is, they are moving some of that blue area down against our lease and they are moving the red area onto our lease. We don't believe that this is really proper. We feel that our correlative rights are being jeopardized.

Q In other words, they are just passing their problem on to Continental?

A Yes, sir.

Q Is that the sum of it?

A Yes, sir.

Q Mr. Lyon, you heard the testimony of Mobil this morning or yesterday, I believe it was, to the effect that Phillips Petroleum Company has given them a waiver of objection as to their Bridges Well No. 29 in

Section 26. Does that change Continental's position in any way on that well?

A Yes, it does. We feel that Phillips is more directly concerned in the injection into No. 29 than we are, and since this is a diagonal offset, we feel that the danger or possible danger to our No. 6 is minimal -- I am not saying it isn't there, but we think it is minimal -- and to demonstrate our willingness, our eagerness to cooperate as far as we can, if Phillips would waive their objection to this well, we will also waive it.

Q Is that based on the assumption, Mr. Lyon, that their Well No. 26 and the Phillips Mabel No. 2 will continue to produce and serve some protection to your lease?

A Yes, sir.

Q Were Exhibits 1 through 9 prepared by you or under your supervision?

A Yes, they were.

MR. KELLAHIN: At this time I would like to offer into evidence, Exhibits 1 through 9 inclusive.

MR. PORTER: If there are no objections, the Exhibits will be admitted.

(Whereupon, Continental's Exhibits Nos. 1 through 9, were offered and admitted in evidence.)

MR. PORTER: Let's give the Reporter a 10 minute break and try to get back and conclude this.

(Whereupon, a short recess was held.)

MR. PORTER: Mr. Sperling, do you have any questions?

CROSS EXAMINATION

BY MR. SPERLING:

Q Mr. Lyon, you in the explanation of your Exhibits indicated particularly with reference to the cross-section which as I understand it is correlated to the Exhibits previously referred to by you and that very few of the Continental wells are completed at this time other than by open-hole completion; is that substantially correct?

A Those that are producing from the Grayburg-San Andres, that's true; with the exception of No. 10, they are all open-hole.

Q Now, even recognizing that fact, do you have an opinion as to the extent of the contribution of the so-called upper San Andres to the current production being experienced by your wells?

A I have no way of evaluating how much of the production is coming from the upper San Andres as compared to the lower in those wells which are open in both.

Q Could you base any sort of opinion on the experience that you have had with the work-over, with the recompletion in the lower San Andres with substantially increased production; does that lead you to any kind of conclusion as to whether the upper San Andres or the lower San Andres is making the greatest contribution?

A Well, the only conclusion that I draw from that work is that there are additional zones in the 9th Massive which we have potentially productive.

Q Well, then, I take it you have no opinion either way as to the state of depletion of the upper San Andres?

A I have not investigated that particular thing so I have no opinion.

Q You indicated that you were quite optimistic as a result of the success that you enjoyed in the one work-over that you have completed as to the productivity of the lower San Andres and that only recently has that completion been made?

A Yes, sir.

Q Is there any particular reason why you delayed completion by this method as to the other wells?

A Well, this work was done in July, and I think that it is a very businesslike procedure to evaluate after you have done work. Also, as you probably know, in large Corporations, it sometimes takes a little time to get approval to do this work.

Q You stated that your observation of the success of Marathon in completing their wells included, as I understand it, the running of liners, and did influence you in going ahead with the remedial work that you have taken, is that right?

A Yes, sir.

Q Do you know when that remedial work commenced by Marathon?

A Not for certain. I haven't looked at those particular scout tickets. Some of the recompletions have been in the last two or three years, as I understand it.

Q Well, there were some earlier than that, were there not?

A I think this is true, but I have not looked

at the dates of recompletion on them. I am sure that the Commission has records of those things that we can check.

Q Well, at least their success dates back over a period of two or three years, whereas, yours dates only from July?

A That's true.

Q So with that being the case, it does take quite a while to sell management?

A Yes, and I think that when you start a remedial program, in order to do it most effectively, you need to evaluate each job because each job isn't exactly identical to the one before it.

Q Now, you stated that in your opinion, Continental would suffer damage as a result of Mobil's proceeding in the fashion which they are requesting of the Commission. I don't believe you were very specific as to what that damage would consist of or how you appraised it and its magnitude. Could you do that for us?

A I can give you a general idea of the areas that I am concerned about. I cannot give you an appraisal of the exact damage because this is speculative and I haven't made this type of a study. The damage that I have

in mind is the fact that we feel certain that water will be pushed to our open-hole completions; that we will have to lift this water together with the oil that we are producing from those wells. We also feel that the fluid saturation will be disturbed to the extent that when we are ready to waterflood on our lease, our flood will be less efficient than if you had not injected directly offsetting our lease.

Q Well, would you recognize that in the course of pushing water toward your lease that it might also push some oil?

A We would certainly hope this would be the case.

Q Well, would you think the oil pushed to you would be greater if the last row of injection wells were foregone or if the last injection wells proposed by Mobil were drilled?

A Would you state that again, please?

Q Would there be more incremental oil pushed to you by the foregoing of the drilling of the last row of injection wells as proposed by Mobil or by the drilling of the last row of injection wells; in other words, if the last row isn't drilled, are you going to have more oil pushed to you or less oil than if the last row of

wells is drilled?

A Well, in the first place, I think Mobil is proposing to drill one well unless something has been changed that I wasn't aware of. The other wells are in existence, and if the wells directly offsetting our lease which we have objected to are placed on injection, I think that probably there will be more oil pushed to our lease than if Mobil withheld injection into these wells. Does this answer your question?

Q Yes. In other words, drilling of the last row of injection wells would result in pushing more oil to you, is that correct?

A Yes, sir.

Q Is that an element of the damage that you are speaking of?

A No, sir. We are not concerned about your pushing oil to us. We are concerned about your changing the fluid saturations on our lease to the extent that the waterflood conducted on our lease when we are in a position to conduct it, will probably make it less efficient; that and the fact that we would prefer not to have to handle the water that you would be pushing

toward us. If it was to our advantage for you to put those wells on there, that is, if we thought it was to our advantage, we wouldn't be here objecting.

Q Didn't you state earlier that you weren't sure of what the effect was going to be, what the damage was going to be?

A That's right.

Q You mentioned the change in position of the so-called red area as shown on Exhibit 4 of Mobil, in effect transposing it down across the line to Continental's Lease. You are aware of the fact, I am sure, that the well proposed to be drilled by Mobil as an injection well is on the south line of the Bridges Lease?

A Yes, sir.

Q It is closer to Mobil's producing well by several hundred feet than it would be to any producing well of Continental's?

A 200 feet.

Q 200 feet. Would you expect that the producing wells served by closing that pattern as Mobil proposes, would water out prior to the sweep reaching your producing wells to the south by reason of that distance?

A I am not sure I completely understood that.

Would you state that again?

Q Well, the Mobil well to be drilled, proposed to be drilled on the south line of the Bridges State Lease is some 200 feet closer to the Mobil producing well to the north, immediately to the north than it is to the closest producing well which I believe is possibly your No. 6 Well to the south?

A Yes, sir.

Q Would you anticipate that the sweep of the water as a result of injection from that well would reach Mobil's producing well prior to the time it reached you?

A Not necessarily.

Q Why?

A Well, in conducting a waterflood, you inject water into injection wells. It has been testified that bottom-hole pressure in the injection wells will be in the neighborhood of 3800 pounds. You have producing wells alternating with the injection wells and the pressure at the rock face in your producing wells, we hope, approaches zero. You push fluids by virtue of differentials in pressure from your injection wells to your producing wells, and so far as we can tell, not

having any detailed information of the formation outside of the well bore, we assume that it goes in a radial pattern until there is some situation which causes it to deviate from this -- and this is the difference in pressure, permeability and this sort of thing -- which as far as permeability, as I say, we have no way of predicting what it does between wells. But you have -- let's see, I can't see the numbers of those wells -- but your No. 29 and your No. 15 are also injection wells. Those wells will have the bottom-hole pressure of approximately 3800 pounds. Now, around Well No. 26, there will be a pressure trough and we hope that the pressure will be approximately zero at the rock face, but when you get out into the formation, the pressure must necessarily increase, otherwise, you get no fluid movement into the well bore. And the same way, away from the injection well, the pressure decreases, otherwise, you would not be able to pump water into the formation.

Well No. 15 and Well No. 29 are pressure peaks, and at some time after you have injected water, you will encounter interference from 15 and 29 to cause the water to move preferentially to an area of lower pressure which is going to be both toward No. 26 and

to No. 6, our well. The area of low pressure, I would think, would be larger to the south and, consequently, I think there is a good possibility that this could change the injection pattern to the extent that they might have water intrusion at the same time.

Q Well, your answer disregards the influence of the well to be drilled 100 feet north of the lease line, doesn't it?

A No, that's the one I am talking about.

Q Well, you designated Well No. 15 as an injector and Well No. 29.

A Well, it is my understanding that you are proposing to put those wells on injection?

Q True.

A Well, in answer to your question, I can't ignore the effect that those wells have on the pressure distribution caused by the well you propose to drill.

Q You mean 100 feet north of the lease?

A Yes, sir.

Q Well, would you agree with me that the effect of the well on the lease line would tend to increase the oil saturation in the vicinity of the well bore of your No. 6 Well?

A It should, yes, ahead of the water.

Q Is that a desirable condition so far as Continental is concerned?

A Well, it depends on how efficient your flood front is. If we were to have a zone of high permeability -- and I don't know whether there is one there or not -- we could get a small amount of oil and then a large amount of water.

Q Do you have an opinion as to whether the rate of injection at that point would have an effect upon the possibility that you mentioned, either minimizing it or increasing it?

A Certainly, the rate of injection has many effects, not the least of which is the rate which the area surrounding the well becomes saturated with water.

Q Are you saying in effect, then, that the reduced injection rate of the well proposed 100 feet north of the lease line of the Bridges State would minimize the danger to Continental's producing wells?

A It would delay the time that there would be any effect noticed in our No. 6 from the injection into that well if the rate is reduced.

Q Now, you mentioned that with reference to

Well No. 29 and injection into that well that you had no objection to that, is that right?

A My statement was that if Phillips is willing to waive -- and it is my understanding that they have waived objection -- that we will also withdraw our objection and will waive objection on that well.

Q Well, did you have that same feeling at the time of the June 10th Hearing?

A Well, at that time I don't believe you had had a waiver from Phillips.

Q But is your objection or lack of it at this time occasioned by the introduction now of Phillips to a waiver or were you of the same substantial opinion that it wouldn't affect you at the time of the June 10th Hearing?

A At the June 10th Hearing, we felt that our interest would be better protected if 29 were not placed on injection.

Q Did you specifically object to the placing of 29 on injection at the time of the June 10th Hearing?

A I believe that our objection was to any well which was located closer than 1650 feet from our lease line and this included Well No. 29.

Q Well, then, you meant to object by that statement to the drilling of the 29 Well at that time or the use of it as an injection well at that time?

A Yes, we did.

Q As I understand the completion methods of Marathon at the present time, they have run liners to isolate the lower San Andres, and then shutting off the upper San Andres in their completion methods, is that correct?

A Yes, sir, that is true.

Q Have you given consideration to a completion such as that in the proposed recompletion program of Continental?

A At the present time we have no plans to run liners in our wells.

Q Your plan is simply to deepen them into what you call the 9th Massive?

A Yes, sir.

Q And in effect, let them remain open-hole completions simply deepened?

A Yes, sir.

Q So to that extent, your recompletions do differ from Marathon's, at which you have apparently been quite

successful?

A Yes, sir. I am not real familiar with the reason which caused Marathon to run the liners, but the fact that they ran liners I don't believe places any obligation on us to run liners in our wells. If we see a need to run liners, then, we will certainly evaluate this and if it appears to be profitable and desirable, we will run liners.

Q Now, you mentioned the Phillips well to the south, and I believe on one of your tabulations on cumulative production you made reference or showed along with the other wells the Mable No. 3 Well. As a matter of fact, it appears on your cross-section, I believe.

A Yes, sir.

Q As the well farthest to the left on the Section. Have you made any investigation of the decline of the production in that well which appears to be completed in the upper San Andres?

A It has been quite sharp.

Q As a matter of fact, in one year it has declined from approximately 1800 barrels a month to

to 765 barrels a month which is shown on your tabulation of current production?

A Right.

Q Can you reach any conclusion from that as to the state of depletion in the so-called upper San Andres in that well?

A Well, you would expect to be pretty well depleted since it is a twin well to No. 1 which had produced 188,000 barrels. I would suspect that it is fairly well depleted.

Q Does that indicate to you any question with reference to reserves in the upper San Andres insofar as the western third of your lease is concerned?

A Well, as I say, I have not made an investigation as to which part of the San Andres our wells are getting their production. I don't believe I am able at this time to make such an evaluation. It might cause us to look at it a little more closely if we were trying to differentiate between zones.

Q What is the current reported production for your No. 6 well and the No. 4 well in the San Andres?

A No. 4 is shut in.

Q It is open only in the upper San Andres; at

least it didn't penetrate the so-called 9th Massive zone?

A Yes, sir.

Q Does that give you any indication as to the state of depletion of the upper San Andres at that location?

A It appears that the zones that are contributing to production there are pretty well depleted.

Q Is the same true of the No. 6?

A No. 6 produced 224 barrels which is about 7 barrels a day in July.

Q Would you consider it to be in an advanced stage of depletion so far as the upper San Andres is concerned?

A Yes, sir, this is why we would like to deepen it. It is the same pool, I might point out.

Q Getting back to the well on the lease line or approximately on the lease line immediately north of your Well No. 6, in view of your prior testimony as to the effect of injection rates into those wells, do you have an injection rate limit to suggest insofar as that well is concerned?

A We would prefer you didn't inject at all.

Q I realize that. As Mr. Porter said yesterday,

we wasted an hour if you and I were in agreement.

Short of total abstinence, do you have a rate to suggest acceptable to Continental?

A No, not at this time.

MR. SPERLING: I believe that's all.

MR. PORTER: Does anyone else have a question at this time?

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Lyon, in answer to questions by Mr. Sperling, I believe you testified that injection of water in a well 100 feet north of your No. 6 well would increase the oil saturation of that well, is that correct?

A I think most probably it would.

Q You heard Mr. Kelly's testimony to the effect that some 5114 barrels of oil would be pushed to Continental's No. 6 as waterflood oil, did you not?

A Yes, sir.

Q And over a 15-year life of the pool?

A Yes, sir.

Q Is that volume of oil sufficient to pay for the additional operating cost that would be occasioned by the influction of water in that well?

A I believe we did a little figuring on that and that figures about a barrel of oil a day, and this is not very economical production.

Q Actually, Mr. Lyon, what you are really concerned about is the deeper zones, is it not?

A Yes, sir.

Q And is it your opinion that the influx of water in No. 6 well would cause a hazard to any future development of those lower zones?

A Well, we feel that it jeopardizes our primary reserves under that well which we believe we have good reason to expect to exist there.

Q Some questions were asked about the position of Continental on the June 10th Hearing in connection with Well No. 29. At that time was Mobil asking for injection only in the upper San Andres formation?

A No, they were not.

Q Would that change your position in connection with Well No. 29?

A Yes, sir. This certainly affected our decision to withdraw our objections on that well.

Q Do you feel that injection of water into Well No. 29 will have no effect whatsoever on your lease?

A I didn't say that.

Q Do you feel that?

A I feel that it will have some effect on our lease, yes.

Q Do you feel it will be minimal?

A Yes, sir.

MR. KELLAHIN: That's all I have.

MR. SPERLING: No further question.

MR. PORTER: If there are no further questions, the witness may be excused.

(Witness dismissed.)

MR. PORTER: If this concludes all of the testimony, we will hear any statements that anyone wishes to make?

MR. MORRIS: Marathon does not believe that it can cooperate with Mobil in the flood that it is proposing in the south end of the Vacuum Field of the San Andres without jeopardizing its primary and secondary reserves which have been shown in this Hearing to be substantial.

Mr. Zeman, you will recall, testified for Marathon that in the upper San Andres zone there were approximately 300,000 barrels of primary oil remaining

to be produced, recoverable reserves, and 400,000 barrels of secondary reserves recoverable. Now, it is obvious here that despite the debate that has gone on between lawyers and witnesses and that sort of thing, that injection by Mobil as proposed is going to adversely affect Marathon's acreage. There is simply no way that Mobil can come along and inject water in quantities and of the pressures that are contemplated without pushing some water over onto Marathon's acreage.

Now, it is certainly true that water injected will move more rapidly toward the area of least pressure. We don't have any quarrel with that as far as it goes, but it is also true that the injected water will move in any direction toward areas of lower pressure. And where you are talking about a 3800 pound injection pressure and the pressure under Marathon's acreage in the upper San Andres of approximately 750 pounds, it is obvious that water is going to move onto Marathon's acreage.

Particularly, I would like to ask the Commission to consider the effect of the injection into a proposed well 13 and 25 and what the effect of that injection would be on Marathon's Well No. 4 where it

is receiving a two-way push in those injection wells by direct offsets, one of the wells being offset to the north and the other offset directly to the west. There is simply no question that that water will move toward and on to Marathon's acreage, and toward and past Marathon's wells. It is just a question of time. Now, that time will be a relatively short time in view of Mr. Paxton's testimony and the study that he has made of the break-through experience in other areas of Mobil's waterflood, particularly in the south area immediately north of Marathon's acreage.

I would like to remind the Commission of the testimony that Marathon's wells 1, 3 and 4, presently are top allowable wells in the lower San Andres and they were made so by work-overs. It is our feeling that Marathon should not be penalized, should not be put in a worse position by having worked over its wells and put them in top allowable shape. Certainly, we are not in any position to participate in a waterflood of the upper San Andres because we cannot protect ourselves by producing the oil that would be swept toward our wells and on by the wells by the proposed injection program.

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Now, in addition to jeopardizing Marathon's primary and secondary reserves in the upper San Andres zone, Mr. Paxton also has shown to the Commission that the reserves in the lower zone also are threatened in that the conditions of wells 13 and 25 are not suitable for injection and cannot be made so.

Now, as to proposed injection Well No. 14, we would like very much to cooperate with Mobil, but there are a few "ifs" involved here. We are not in as clear-cut position, unfortunately, as Continental was with respect to the one proposed injection well. We have no assurance from Mobil how its well, its producing Well No. 11 will be operated; nor do we have any assurance nor can we obtain any assurance from Texaco on how its Well No. 3 to the south of the proposed injection Well No. 14 will be operated. Only if these wells are operated and produced at maximum rates will they serve as a buffer and as protection against our Well No. 2.

Lacking the assurances that we need with respect to how the injection into Well No. 14 will affect us, we must also oppose the injection of water into that well.

Finally, we would like to further make specific objections to Well No. 13. It was not within the Notice that was given of this Hearing and we submit that the Commission has no jurisdiction to grant the relief that is being sought with respect to Well No. 13. We also like to observe with respect to that well that there is no present need by Mobil for the authority that they seek to convert Well No. 13 from the Blinbrey Well to an injection well because Mr. Kelly stated that it would not be needed in any event for at least three to five years. We submit that the request for approval of that well in any event is premature.

We respectfully request that the Commission adhere to the Order that was handed down following the Examiner's Hearing in this case and deny the Application of Mobil as respects the injection of water into the three wells that directly offset Marathon's acreage as well as -- I am referring to all three wells; that is, No. 13, No. 14 and No. 25.

MR. PORTER: Mr. Kellahin?

MR. KELLAHIN: If the Commission please, Continental Oil is substantially in agreement with the position that has been stated so ably by Mr. Morris.

I don't think we need to repeat the testimony which he has reviewed. Continental is in a slightly different situation in that we have two direct and one diagonal offset injection wells on our lease, one of which would be located within 100 feet of the lease line.

Now, there has been a lot of talk about the fact that Mobil only proposes to flood the upper San Andres. This is, of course, their privilege if they want to flood a particular zone in a particular pool, but I do not think we should lose sight of the fact that the Grayburg-San Andres Pool in the Vacuum Field is one single pool. It is not incumbent upon Continental or any other operator to run liners to protect themselves against the offset operators as has been suggested by Mobil, at considerable expense, when their wells in full compliance with all of the Rules and Regulations of this Commission have been completed open-hole and all of which are open in the upper San Andres.

Our chief concern, of course, is not so much the volume of oil that remains in the upper San Andres formation. Mr. Kelly testified that the No. 6 well would probably receive 5000 barrels of oil over a period of

15 years and obviously, that is not even economical, assuming there were no extra ordinary costs involved.

If Continental is to be permitted to recomplete its wells in the lower portion of the San Andres, which it has the perfect right to do, it should be able to do so without running the hazard of water encroaching into that well through the activities of Mobil offsetting its lease. For that reason, in order to protect the correlative rights of the operators, we agree with Marathon that the orders of the Commission entered in the case as heard before the Examiner, Orders 3984 and R-3983, should be in all respects affirmed with the exception that insofar as Continental Oil is concerned, we have withdrawn any objection to the Well No. 29.

As indicated by some of the cross examination, perhaps Mobil would like us to restate that objection and if you want us to, we would be happy to do so. If they don't request it, we won't restate it.

MR. SPERLING: I am glad to see that the copy of the waiver which I presented to Mr. Kellahin yesterday and recommended to him highly received some acceptance.

The arguments of counsel for Marathon and Continental seem to proceed on the theory that only the correlative rights of those two companies are involved in this matter. I would like to remind the Commission that there are correlative rights upon both sides of these lines including those lease lines which encompass the Bridges State Lease.

— It is unfortunate that the fields aren't all developed at the same time and at the same rate by the same operator and the oil isn't found and produced simultaneously so these problems that are presented from time to time to the Commission don't present such dilemmas. That, unfortunately, is not the way it operates and that's the reason, of course, that we have the Commission to help us solve these problems.

I think the testimony of Mobil has amply demonstrated that the waterflood reserves which they have on the Bridges State Lease must be produced in the interest of conservation. The testimony has also shown -- and I don't recall any testimony of substance to the contrary -- that a considerable amount of otherwise recoverable oil under the Bridges State Lease will be lost irretrievably by the failure to conduct

waterfloods as proposed by Mobil.

The amount of oil already recovered has been substantial and the amount of oil to be recovered, that is potentially recoverable even under Mobil's proposed plan is quite substantial. I recognize that both Marathon and Continental have problems insofar as the development of their respective leases are concerned. By the same token, so does Mobil.

The question really becomes one of whose ox is gored the least in this kind of a situation. We believe that we have shown that what they stand to gain, that is, Marathon and Continental, or if you want to put it another way, what they stand to lose, is minimal compared to what Mobil stands to lose insofar as the operation of its property is concerned with the deferral of the granting of the authority sought in this Hearing, for a period of time ranging up to the highest estimate, I believe, 17 to 18 years. This seems to me unconscionable unless there has been definite testimony satisfying the Commission that there will be substantial damage to the offset operators under the plan proposed by Mobil to deny the obvious benefits accruing to all parties concerned and including the

State of New Mexico as a royalty owner from the operation of the flood proposed by Mobil.

Now, if it does seem to the Commission that there is -- I don't believe it has been shown that there is -- but if there is a substantial as distinguished from minimal hazard to either of these operators, it seems to me conceivable that safeguards could be written by the Commission into an Order which would provide the protection that might be indicated to the extent indicated.

I certainly am not going to tell the Commission how to write its Orders. It has been at it a long time and it does a good job, but I am sure that the Commission has encountered situations which require safeguards in the past if it seems imminently clear that they are indicated and this certainly could be done in this case.

On the other hand, I don't believe that the possibility which has been suggested on behalf of the offset operators in this case outweigh the real benefits to be obtained from the orderly operation and development of this flood proposed to be in operation for some time by Mobil.

MR. PORTER: Does anyone else have any
comments or any statements to make in this case?

The Commission will take the case under
advisement.

The Hearing is adjourned.

(Whereupon, the Hearing was adjourned
at approximately 11:55 A.M.)

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

I, RICHARD L. NYE, Court Reporter, do hereby certify that the foregoing portion and attached Transcript of Hearing, page through page inclusive, before the New Mexico Oil Conservation Commission was reported by me, and the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.


RICHARD L. NYE, Court Reporter

My commission expires April 8, 1971.

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BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
State Land Office Building
Santa Fe, New Mexico

September 16, 1970

REGULAR HEARING

IN THE MATTER OF:

Application of Mobil Oil Corporation,
for a waterflood expansion, Lea County,
New Mexico.

Case No.
4367
(De Novo)

Application of Mobil Oil Corporation,
for a waterflood expansion and amendment
of rules governing same, Lea County,
New Mexico.

Case No.
4368

BEFORE: A. L. Porter, Jr., Secretary-Director
Alex J. Armijo, Member

MR. PORTER: Now, in Cases 4367 and 4368 the Commission would like to have the appearances.

MR. SPERLING: James E. Sperling of Modrall, Seymour, Sperling, Roehl and Harris of Albuquerque appearing for Mobil Oil Corporation.

MR. MORRIS: Commission please, Richard Morris and Owen Lopez of Montgomery, Federici, Andrews, Hannahs, and Morris of Santa Fe and Mr. Jack McAdams of Houston, Texas, all appearing for Marathon Oil Company.

MR. KELLAHIN: Jason Kellahin of Kellahin and Fox, Santa Fe, appearing for Continental Oil Company.

MR. PORTER: We will recognize Mr. Sperling.

MR. SPERLING: Mr. Porter, we have one witness, Mr. Kelly.

MR. PORTER: Mr. Kelly, would you take the stand at the end of the table, please.

By the way, I think we can have witnesses for all of the parties appearing stand and be sworn at the same time.

PAT KELLY

a Witness, being duly sworn according to law, upon his oath testified as follows:

MR. HATCH: Mr. Sperling, are all these exhibits to be marked?

MR. SPERLING: Yes. They have.

I might state that the stapled exhibits are before Mr. Porter with the exception of Exhibit No. 1 which is the plat on my far left and there are two other exhibits which are rather long and which I didn't have space enough to put them up. Those are Exhibits 10 and 11. Otherwise, Mr. Porter's packet is the complete exhibit.

DIRECT EXAMINATION

BY MR. SPERLING

Q Mr. Kelly, would you please state your full name, the name of your employer, your place of residence and the capacity in which you are employed?

A My name is Pat Kelly. I live in Midland. I am employed there by Mobil Oil Corporation as a Petroleum Engineer.

Q Are you familiar with the Vacuum field in Central Lea County, New Mexico?

A I am very well familiar, I think, with the San Andres reservoir of the Vacuum field in the general vicinity of Mobil's Bridges State lease which comprises almost all of the Northern Nose of the Vacuum field -- approximately one-third of it, maybe a little less.

Q Mr. Kelly, have you, on any previous occasion, testified before the Commission as an expert in the field of petroleum engineering?

A Yes, sir.

Q Your qualifications then are a matter of record?

A Yes, sir.

MR. SPERLING: Are the witness' qualifications acceptable?

MR. PORTER: Yes. They are.

Q Mr. Kelly, you have stated that you are familiar with particularly Mobil's acreage within the Vacuum field in Central Lea County, New Mexico. You, in that capacity, I assume, are aware of the fact that a waterflood project has been previously authorized by the Commission in that area. Would you state generally what the extent of Mobil's participation has been in the waterflood project, both in the past and currently.

A I believe there are currently two waterfloods in the Vacuum field underway. One is operated by Texaco. The last time I looked into it it was what I called an inverted Nine Spot Flood. It is situated on the West San Andres unit, I believe it is called, immediately southwest of the Bridges State lease. The other waterflood in the field that is active now is that on Mobil's Bridges State lease and surrounding leases, the State G and the State J and finally the State II.

Q Would you please now step to the board behind the Commission there and indicate what has been marked as Exhibit 1 in this hearing and explain the purpose and what it represents.

A Exhibit 1 is an area map encompassing, I believe, the entire Vacuum field. It has shown on it all of the wells that have been drilled regardless of what reservoir they were completed in. It shows the acreage operated by Mobil within the area of the map colored in yellow; the Continental State II 35 lease colored in orange and the Marathon State McCallister lease colored in purple. The Bridges State lease is found in this area here. It covers some fifty-five hundred acres or so and blankets almost all of the Northern Nose of the structure. The general outline of the field follows this line here and the crest of the structure is in the vicinity of the Phillips Hale lease in Section 35 and Mobil's 1 lease in Section 36. It falls to the North and the South from that point. There is also structural relief to the East and West in this area where the Northern Nose plunges off the anticline and Mobil's property is, for the most part, situated on that Nose.

Q Well, I take it that that exhibit shows the area of the waterflood presently being operated by Mobil?

A Yes, sir. The map has identified on it the injection wells that Mobil operates according to the legend and currently takes in all of the acreage from the extreme North end of the Bridges State lease in Section 3 down to about the mid-point of Section 26 on the South -- approximately the South half of Section 26 and only the North row of wells in Section 25 are

currently in the waterflood.

Q What is your area of specific responsibility with reference to the waterflood being operated by Mobil?

A I am the Project Engineer on this waterflood. I took it over in 1967 about the time that it was undergoing a major expansion from the old Pilot Flood that started in 1958.

Q Now, would you please refer to what has been marked as Exhibit 2 and explain what it is and its purpose.

A Exhibit 2 is the map shown here. It is intended to identify all of the San Andres wells that have been drilled in and around the Bridges State lease. You might note that Exhibit 2 is just a blown-up, a larger scale map of the Bridges State and surrounding property. It doesn't take in the entire Vacuum field as does Exhibit 1.

I have color coded on Exhibit 2 in red circles the wells that are apparently completed in or producing from the San Andres formation. Color coded in blue are the wells which I have identified in this area as having been formerly completed in the San Andres formation and recompleted at another time in some other zone or in one or two cases I believe the wells have been plugged. I wanted to identify those San Andres wells because there are many reservoirs on the vacuum structure and there are a lot of twin wells shown on the map that are complete in other zones. This will afford some basis for determin-

ing where the San Andres production actually is.

Q Well, the San Andres is the subject of the waterflood operated by Mobil at the present time.

A Yes, sir. The only waterflood we have underway in the Vacuum field now is in the San Andres formation.

Q Would you refer now to what has been marked as Exhibit 3 and explain that exhibit and its purpose.

A Exhibit 3 covers the same area as Exhibit 1. It also has some wells circled and colored, identified according to the legend. This map shows only the water injection wells in Mobil's San Andres waterflood. It shows in red the original six water injection wells that water was started into in December of 1958 in the old Pilot Flood. Adjacent to the Pilot are two wells colored in brown which were injection wells converted in 1963 in an expansion of the Pilot Flood. The next expansion of the Flood took place in 1967 and included all of the wells that are on this map colored in either green or orange. Because it takes some time to install the facilities necessary to waterflood, that is the injection lines, necessary gathering lines, the pumps to pump the water and all, why, it developed that we were able to put some of the wells on injection a little earlier than the others in the 1967 expansion and the wells that we started water into first are identified in green here. We injected into those beginning in May of 1967

and the wells colored in orange we began water into as those facilities were completed in October of 1967. At the end of the 1967 expansion we had all of our developed acreage in Sections 13, 14, 23 and 22 and part of 24 under flood.

In 1968 we drilled another injection well No. 127 here and put it on. In 1968 we bought the Phillips Petroleum Santa Fe 10 from them in 1968 and put it on injection here and about the same time we put our State G No. 3 on injection. We were actually prepared to inject into State G No. 3 at the time of our '67 expansion but we had reason to believe at that time that there was a unit going to go to the East here which was then and is now being expedited by Phillips and we had developed some co-operative plans for injection along the common line between our property and Phillips and we were intending to delay injection into No. 3 until the Phillips unit went into effect. As it developed, Phillips ran into some trouble somewhere and was unable to get the unit formed at that time, so we went ahead and converted and started water into G-3.

The next expansion that we undertook was the one that finally precipitated this hearing today. On June 10, 1970 there was a hearing before the Commission for the purpose of considering Mobil's application to expand waterflooding operations on their Bridges State lease to include the balance

of the acreage on the South end. That would include all of our acreage on Section 25, 26 and 27. Also at that time we asked that our original waterflood order for the Bridges State lease be amended so as to allow further expansion by administrative action. Following the hearing the Commission granted that request along with modified, I'd say, partial approval of the remainder of the application and since then we have converted and started water into these wells colored light blue on the extreme North end of the lease. The wells on the North end are all co-operative injectors with the Yates Brothers that have formed a unit. It is not identified on this map, but in general the acreage North of the Bridges State Lease there is productive in the San Andres, is now within a unit operated by Yates and I understand they are in the process of converting their wells.

The injection wells we wanted to use and ask for permission to use in the June 10th hearing that the Commission denied us authority to use are Bridges State No. 29; a new injection well that we propose to be drilled one hundred feet from our lease line -- that is 560 feet South of the producing well No. 26 to close up that pattern; Bridges State No. 15, No. 25, No. 14 and another well that we propose to drill 330 feet from the lease line in the location of Section 25. Our request at that time was for authority to inject into any

of the oil bearing porosity that we had or might find in the San Andres formation. We encountered substantial opposition to that application by both Continental and Marathon, operators of the orange and purple colored leases here, and I viewed in part or to a major extent because of the ample reserves that Marathon has demonstrated underlies this property in the lower San Andres and the ample reserves that Continental thought it probably had in the lower San Andres. Now, we recognize -- I recognize that there are substantial reserves in the lower San Andres and know that the lower San Andres is much more prolific as you proceed South on the Vacuum structure.

In part, in an effort to avoid some of the controversy with respect to our injection along the South line and also because Mobil's reserves are really in the upper San Andres where we have got almost all the oil we have produced on the Bridges State lease, we have decided to eliminate a portion of the request that we formerly made and at this time ask the authority to inject into the same wells that I just identified with one exception in Unit E of Section 25. We are proposing at this time that these wells be authorized as injector into the upper San Andres pay only, having the lower San Andres plugged off in some acceptable way because I believe that it is necessary for us to inject into the lower San Andres in Unit E of Section 25 if we are to produce enough oil out of

that pattern to justify drilling the extra well which would encompass the lower San Andres and I have decided not to recommend to my management that we drill that well and am relying now on utilizing former San Andres well No. 13, that which is approximately 660 feet from the West line and 660 feet from the South line of the lease; the West line of Section 25 and the South line of the lease that is Marathon's lease North line and recomplete that well in the San Andres at such time as the well bore becomes available.

You will note from the map earlier introduced, Exhibit 2 or 3 -- Exhibit 2 -- that No. 13 has been recompleted from the San Andres into some other zone. It is a Blinbry well now and by my estimate has some three to five years to go before it will deplete its Blinbry reserves.

I would like the Commission to grant authority, as a result of this hearing, for Mobil to inject into well No. 13 into the upper San Andres at such time as the well bore becomes available; that is after the Blinbry reserves are depleted.

Q As I understand you, Mr. Kelly, you are now asking the Commission to grant authority to inject only into the upper San Andres insofar as those injection wells proposed located on the South end, the extreme South end of the Bridges State lease?

A Yes, sir, with respect to the Southern most row of wells only. We have the lower San Andres open in some of the other wells that are already in use for the North lease. I think there are some oil reserves under the Bridges State lease in the lower San Andres, but except on the extreme South end of the lease I think they are somewhat speculative and I am not really sure how much we will get out of there. I do know that almost all of the oil we have made on the property has come from the upper San Andres and I regard it as imperative that we enclose this Flood on the South side and in order to enclose it and get the oil that I really think that we have, that I am sure we have on these properties, I would modify the application, amend the original application and ask authority now to inject into those locations set out on Exhibit 3 in triangles, into the upper San Andres only.

MR. MORRIS: If the Commission please, may I interpose an objection at this point that the witness has stated here that he wishes to amend the application that is pending before the Commission at this hearing which is, of course, an admission that this is not a De Novo hearing from the original application but is in effect a new application to this Commission. We would suggest to the Commission that this De Novo hearing go no further and that the matter be referred to Examiner for an initial hearing in this matter.

MR. SPERLING: Commission please, the relaxation of the original -- if that is a good word -- of the original application certainly is not an expansion of anything that was requested at the initial hearing. We felt that in view of the opposition which has arisen at the time of the other hearing that some points had been made by that opposition and this is an attempt to meet that opposition in a fair way. We do not think that this is a jurisdictional question at all. The Commission has before it the action taken by the original Examiner. It also has before it the statement of the witness at this time concerning the proposal now made which is in recognition of the points made at the previous hearing. We do not believe that this constitutes a new application since it involves identical wells, the identical formation, the identical flood is that which was the subject of the prior Examiner hearing and we think that in view of that, that the Commission is perfectly justified in going ahead and hearing this De Novo as requested.

MR. PORTER: Mr. Kellahin, as counsel for the other party in this case would you care to comment on the motion by Mr. Morris?

MR. KELLAHIN: Commission please, we feel that technically speaking Mr. Morris' objection is well taken. Continental Oil Company, however, feels that the proposed change in the application is at least a step toward improving

the situation to which we had objected and for that reason we have no serious objection to the change.

MR. MORRIS: May I address the Commission again on this point, please?

MR. PORTER: Yes.

MR. MORRIS: Mr. McAdams has pointed out to me that the change that we encounter here in the application is prejudicial to the position of Marathon in this matter in that we have prepared our evidence in this case to meet the thrust of the original application in this case. Now we learn that -- we have had no advance warning of this at all -- we learn that the application in effect is changed and that the evidence that we have prepared here, which you would ordinarily prepare on a De Novo case, does not directly meet the thrust of what we understood the application to be.

Now, this is prejudicial to us because if this matter were to be first considered in an Examiner hearing, then the party adversely affected -- whether it be Mobil or whether it be Marathon -- would have the right to apply later to the Commission for De Novo hearing if that should be necessary and I think that it runs afoul of the procedures that have been established for operating the Examiner hearings before this Commission and the De Novo hearings to permit an applicant to come in at a De Novo hearing and substantially change his application as Mobil has done in this case, so it is not

simply a matter of this case either being heard by the Commission or by an Examiner -- we feel that our rights will be substantially prejudiced unless this matter is assigned to an Examiner and we renew our motion that the matter be referred to an Examiner at this time.

MR. PORTER: Mr. Morris, in other words, you still -- your client still objects to the proposal as made by the applicant, as modified by the applicant?

MR. MORRIS: That is correct. Now, as Mr. Kellahin stated, it is not as onerous as their original application, but we still object to it and we believe that we can demonstrate that waste will occur and that our correlative rights will be impaired by the application in its modified form.

MR. PORTER: So if the Commission should grant your motion and should dismiss this case and it were referred to an Examiner -- called up again -- then we would have to go through the same procedure that we have already. In other words, we'd have another Examiner hearing; we'd have the same objections, maybe not to the same degree and probably -- I don't know what the results might be before an Examiner, of course -- I can't guess what his recommendation would be or what the reaction of the Commission would be --

MR. MORRIS: Well, that is true, Mr. Porter, but the only reason we object to the Commission continuing and

just going ahead and hearing the case is that we are -- the application has been so substantially modified that it is a new application. It is a new application and we should have the two-step procedure available to us in the event that as the result of an Examiner hearing further De Novo hearing should become necessary. As a new application I don't think that Mobil could say that it was being -- that its rights were being impaired by having to follow the normal procedures for new applications of this type.

MR. SPERLING: I can't agree with Mr. Morris that it constitutes a new application. I know of many instances where the relief sought has been reduced in hearings before Examiners and this Commission. If we were seeking relief which went beyond the original application, that would be one thing and I can certainly understand the claim of prejudice in that instance. I cannot understand any claim of prejudice in this instance when the relief sought is less than that which was originally sought, having in mind the position of Marathon, and I can't agree with Mr. Morris that this indicates a new application.

We have exactly the same subject matter, exactly the same waterflood involved and I cannot see, in the presentation of evidence, how the restriction of the limits of the hearing into injection into one portion of the San Andres as distinguished from the two constitutes prejudice.

MR. PORTER: Mr. Morris, the Commission will overrule your motion or deny your motion and continue with the case.

Q Mr. Kelly, I have some difficulty in recalling where we were, but I think we were on Exhibit No. 3. Have you finished your discussion of the information contained on Exhibit No. 3?

A I believe so, sir. I had just completed to point out to the Commission which wells it is that we are asking for authority to inject into; the locations that were not approved as a result of the June 10th hearing and also pointed out that we are restricting our application at this time from down to injection into the lower or the upper San Andres only whereas in the first instance we had asked for permission to inject into both the upper and the lower.

Q Let me ask you this, Mr. Kelly, for the record, do the lower San Andres and the upper San Andres represent separate reservoirs insofar as classification by the Commission is concerned?

A All of the San Andres oil is, according to my understanding, regulated by the Commission as a common field or common source of supply. It is a fact in my opinion -- and I will have some evidence to introduce on it at a later time -- that there is geological separation between what I identify as upper San Andres and lower San Andres pay within the vicinity

of the Bridges State lease in this waterflood in the offset leases and that there is no interchange of fluids between those zones except perhaps in well bores which have both zones open to production.

Q Well, insofar as the flood as it presently exists is concerned and including the most recent expansion granted by or following the June 10th hearing, there is no distinction as between the lower and the upper San Andres, is there?

A If I understood your question correctly, the answer is "No". It is one oil field, one reservoir as prorated by the Commission.

Q Now, would you proceed to a discussion of Exhibit 4 and what it shows.

A Exhibit 4 is a plat which shows the same area as Exhibits 2 and 3. It shows the injection wells, currently active injection wells on it in the same way -- also the Marathon and Continental tracts colored in the same way. On the South end of the Bridges State lease there is an area that is colored red on this map. That area represents the Bridges State acreage which lies beyond the affect of an enclosed pattern flood by virtue of the Commission's decision pursuant to the June 10th hearing. In other words, whereas the acreage to the North will be influenced by a closed pattern Five Spot Flood, the acreage to the South in the red area will

be influenced generally by a one-way push flood. In general, the injection will be taking place to the North and the flood will be pushed toward the South, under the order that we now have.

Q Well, the red area then represents the area of possible recoverable oil reserves by secondary methods assuming a closed Five Spot Flood pattern, is that correct?

A Yes, sir. The red acreage is what in effect could be swept of its recoverable waterflood reserves by Mobil if it were to be assumed that the flood could be expanded onto the South so that the patterns would be enclosed and if it could be further assumed that we could have lease-line co-operation around the South side. Where you have lease-line co-operation in a waterflood there is generally acreage, floodable acreage given up by one operator in favor of the other, but it balances out over the extent of the lease-line such that we would, if we did have co-operation around the South side, we would end up with equivalent of this red acreage floodable in a closed pattern flood.

Q Have you computed the acreage area of the red colored portion of this map?

A Yes, sir. There are approximately 730 acres colored red on the map.

Q Have you computed in barrels the number of reserves

underlying that red area?

A Yes, sir. Using the techniques that I generally use in computing waterflood reserves I have estimated that the red area is underlying by 1,656,000 barrels of recoverable oil by enclosed pattern flooding in the upper San Andres only.

Q Well now, how did you make those calculations -- what information did you use in arriving at that figure?

A I employed some rock and fluid properties that I have carried in my files as the proper test of the San Andres in the vicinity of the Bridges State lease. A great many wells on the extreme North end of the lease have been cored as the most of the other wells were drilled earlier in the late 1930's and 1940's at a time when there wasn't much core and well logging going on. The average values that have been computed from the core analysis of wells that we have cored comes to about eleven percent porosity in the upper zone. Some other work that we have done indicates the water saturation is about thirty-six percent and some information that we have developed on the fluid properties indicates that the oil was initially under-saturated and had a volume factor of 1.26. These are some of the conditions that went into the computation of those reserves.

Q Have you prepared exhibits which reflect those

calculations?

A Yes, sir. Exhibit 4-A is a sheet containing the basic assumptions that I have made in computing waterflood reserves for Mobil all over the Bridges State lease and the equations that I used to develop those reserves.

Stated broadly, the technique employed was to measure or I will say estimate the net pay volume, the reservoir volume of the rock from the Isopachus map which I will introduce later, and calculate the oil saturation remaining in that reservoir rock at such time as the wells had produced whatever accumulative oil they were indicated to produce at the control points -- in this case it is July 1, '70, at the start of the flood -- and to employ simple material balance equations to estimate the recoverable oil, waterflood oil within an enclosed pattern in that acreage, under that acreage, utilizing the beginning oil saturation indicated. I might observe that I have used a volumetric sweep efficiency of seventy percent in the Five Spot Flood that we have here. I think I have seen some information or former performance developed in the more mature parts of the flood to indicate that we are going to recover reserves of a magnitude that would substantiate a seventy percent volumetric efficiency and a twenty-five percent residual oil saturation within the flooded out area and a five percent residual gas saturation

in the flooded out area. These are the basic assumptions that I have made.

The calculations of the reserve for the red area is summarized in Exhibit 4.

Q So Exhibits marked 4-A and 4-B contain the basic assumptions and the calculations which causes you to arrive at the estimate of recoverable reserves under the red area as being 1,656,150 barrels?

A Yes, sir. Exhibit 4-A contains the assumptions and equations. 4-B contains the calculations with specific regard to the red area on Exhibit 4.

Q Well now, I assume that since you have stated that the red area represents the recoverable reserves, based upon a closed pattern, that you have made some investigation of the affect of a closed pattern as against an open flood pattern on the recovery of those reserves, is that correct?

A Yes, sir. I believe that I have a good estimate of closed pattern reserves for the red area because the order that we are operating under now in this flood does not permit the flooding of the red area in the manner that I assume would take place in the calculations in Exhibit 4-B. I felt obliged to find a reasonable basis for determining the waterflood reserves that we are actually going to recover from that area if we are required to operate under the order that we now have. In order to do that I went back to well performance of

wells around the old Pilot Water Flood up in Sections 14 and 23. That Pilot Flood area is shown on Exhibit 5 and I have the producing wells whose performance I analyzed separate, encircled in red on that map, and I have the injection wells that were influencing them circled in blue. There are some red shaded areas on Exhibit 5 which schematically represent what I estimate to be the approximate floodable area between the injection wells and the producing wells whose performance I analyzed.

Those producing wells are Bridges State wells No. 57, No. 10, No. 55 and No. 54. All of those wells during the Pilot Flood were subject to a one-way push and this is substantially what we will have on the South end of the lease, so I reasoned that if I could determine what proportion of floodable area would be effectively flooded in a one-way push, that I could, by analogy, apply those data to the area to the South and come up with a reasonable estimate of the one-way push reserves for the South end of the lease.

Q Well, would you refer now to what has been marked as Exhibit 5-A through 5-D and explain what those analyses and calculations represent with reference to Exhibit 5.

A Exhibits 5-A through D are sheets showing the calculations involved in analyzing the performance of each of the producing wells around the old Pilot that I just enumerated. 5-A is the analysis for Bridges State well No. 10;

5-B for well No. 54; 5-C for 55 and 5-D for No. 57. I will summarize the calculations for well No. 10 and state the calculation is the same for the other three wells. Well No. 10 is found 1,320 feet South of the injector which I believe floods the well No. 31. Previous to the time that well No. 10 experienced response to injection in No. 31 the pattern that it was producing from had produced 297,000 barrels of oil, approximately. I allocated the cumulative oil to the pattern in this manner. What I was attempting to come up with in the first place was a closed pattern waterflood reserve for the pattern that No. 10 produces from to see what maximum we'd get under or what we'd ordinarily get under closed pattern, so I allocated the one-fourth of the cumulative oil from each of the corner injectors; Bridges State well 6, 7, and 31 and the Amerada State V-A No. 3 and added to that the cumulative oil to January 1, 1964, for well No. 10. That came to the 297,000 barrels.

From the Isopach map I determined that there were 2,850 acre feet within that eighty acre pattern described by the four injectors and one producer. Dividing the production by the reservoir volume it is indicated there is a recovery, a primary recovery to January 1, 1964 of 104 barrels per acre foot. When that is compared with the oil initially in place, 433 barrels per acre foot, it can be seen that twenty-four

percent of the oil in place, initially in place in that pattern had been produced to that time. Depletion to that extent will yield an oil saturation at the start of the flood within the pattern of 40.5 percent which will, using the basic assumptions that I have set out in Exhibit 4-A, will give forty-three barrels per acre foot waterflood reserves for that pattern.

I have the production curve for well No. 10 that I will offer in a moment. It shows that No. 10 had, early in 1964, experienced a response to the waterflood that it went through a typical response period, then began a decline and was approaching the economic limit at the time that the 1967 expansion took place. Extrapolation of that observed decline to the economic limit will give No. 10 well actual and projected waterflood oil of 13,112 barrels in a one-way flood situation. That is the equivalent of recovery, closed pattern recovery from 8.6 acres -- in other words, about ten percent of the eighty acre pattern or about forty-three percent of the area that I interpret to have been flooded out by the injection of the well between 31 and 10. It is a little bit difficult in a direct line drive situation as is the case between 31 and producing well 10 to come up with floodable acres. I think it is a little bit elusive because there aren't any side borders on it, but I determined certainly that there are twenty

floodable acres between the injection wells in the staggered line drive configuration that producing wells 57, 55 and 54 were controlled by in the old Pilot Flood because I went on to determine that 54, 55 and 57 had also recovered the water-flood oil from the vicinity of eight to nine acres -- that is most probably well No. 10 had been influenced by twenty floodable acres also. The numbers came out so close that -- we were so consistent that I concluded it must have been about the same magnitude of floodable area.

The effective acreage flooded to well No. 54 is set out on Exhibit 5-B as 8.1 acres; for No. 55, 7.9 acres and according to the reports for No. 57, 17.4 acres. Well, I calculated 57. I had run through the other three wells first and got such close agreement I was surprised when I came up with seventeen acres for No. 57, so I went back and analyzed the well tests that we had accumulated on the well through the response period and I determined that we had reported to the Commission quite a lot more production for well No. 57 during 1965 and '66 than I thought it could possibly have produced. The well tests during that period were quite a lot less than actual production reported so I went back and estimated the production through the same period for well 57 based upon the well tests that we had and we were taking a lot of them at that time and I estimated that the well had actually produced some

27,000 barrels before reaching its economic limit -- 27,575 barrels before reaching its economic limit in the one-way push flood rather than the 53,000 barrels we had reported to the Commission.

The 27,000 barrels is the equivalent recovery from nine acres, so finally I decided that I had very consistent results from all four wells and it is on the basis of this performance that I have, by analogy, estimated the recoverable reserves from the South end of the lease in the one-way flood.

Q Well, your explanation of what you did appears at the bottom of Exhibit 5-D, I take it?

A Five-D -- you are speaking with respect to No. 57?

Q Yes.

A The bottom of Exhibit 5-D, yes, sir.

Q Do you have any further comment on that?

A No, sir.

Q Now, you made earlier mention of production curves in connection with your explanation of Exhibit 5 as well as 5-A through D. Would you now refer to those curves which have been marked 5-E through 5-H, I believe.

A Exhibits 5-E through H are the production curves representing oil produced over the period from 1957 forward by each of the wells that I analyzed around the Pilot. In numerical order, 5-E is for well No. 10; 5-F is for well No. 54;

5-G is for well No. 55 and 5-H is for No. 57. These curves, incidentally, do reflect the oil production that was reported to the Commission and I have pointed out why I think the curve and the production for well No. 57 is in error.

Q All right now, would you refer to Exhibit 6, please, and explain what it shows and its purpose.

A Exhibit 6 shows connected with red lines -- it is a plat -- it shows connected with red lines the injection wells that is the Southern most row of enclosed pattern that we have in the current flood. It shows colored in blue those patterns that will, under the Commission's current order, be influenced by what I describe as a three-way push in further operations in this area. The red area on Exhibit 6 is the area that I interpret will be influenced only by a one-way push and the green area is that which lies outside of the effective productive area of Mobil's last row of producing wells on the South side of the lease in this flood, by this flooding method.

Q Well, Exhibit 6 then represents your calculations of the sweep efficiency of the various colored areas under the existing order, is that correct?

A Yes, sir. The legend shows the estimates that I have made for those various colored areas. For example, the red area which I interpret will be subject to a one-way push flood I have assumed, for purposes of making reserve calculations for it, that one-half of the closed pattern recovery oil will

actually be recovered. I might note that the average data, average performance of the wells around the Pilot Flood that I analyzed indicated some forty-two percent of the recoverable closed pattern recoverable oil from the floodable area would be recovered. For purposes of simplicity in this reserve calculation I have just assumed instead of forty-two percent it would be fifty percent. I have not analyzed any performance on wells with a three-way push, but my logic tells me that a well -- a producing well subject to a three-way push ought to recover more oil than a well that is subject only to a one-way push. Also I don't believe that it will recover as much of the floodable oil as a well that is subject to a four-way push that is enclosed on all sides, so I have made the assumption for the blue areas that will be influenced by injection on three sides that they will recover an amount of oil which is halfway between the closed pattern recovery and the one-way push assumed recovery of fifty percent. In other words, I have assumed that the blue areas would give up to our producing wells three-fourths of the floodable closed pattern reserves in those areas.

Q Having explained your reasoning and logic with reference to the pattern under the existing order, did you make some calculations as to reserves under those conditions as contained within the respective areas?

A Yes, sir. I have made some calculations of those reserves and they are set out on Exhibit 6-A. From the Iso-pachus map I determined the net pay volume beneath each of the areas, the blue area and the red area, and subjected those areas to the percentage recovery factor that I have assumed, seventy-five percent for the blue area -- one-half -- fifty percent for the red area. After having determined the current oil saturation in that area by the same technique that I employed over here originally where I estimated that the closed pattern waterflood reserve was sixty-one barrels per acre foot, I determined that the blue areas should give up 265,000 barrels of waterflood oil.

Q That is the three-way push.

A Yes, sir. The blue area. That will be subject to a three-way push. It will give up 265,000 barrels of waterflood oil. I have all the red area subject to one-way push will give 472 barrels of waterflood oil, giving a total recovery to Mobil, I believe, of 737,490 barrels from the area that is colored red on Exhibit 4 and which is the sum of the red and the blue areas on Exhibit 6. Mobil will not recover any oil short of lease-line co-operation from the area colored green. That oil will be pushed outside the drainage area of those wells as the water invades from the North and I believe quite a lot of it will be pushed across the lease-line to the

South.

Q Have you made a calculation as to the volume of that green area, that is the volume of oil which is unrecoverable by Mobil?

A I have estimated the volume of closed pattern reserves for the red area on Exhibit 4 that would not be recovered by Mobil in pursuing the flood under the current orders and that volume is 918,660 barrels. In other words, of the 1,656,000 barrels I think are recoverable from the South end of the lease outside the closed patterns that we now have, I believe 919,000 barrels -- in round numbers -- will be pushed outside the drainage area of Mobil's wells and we will get a much smaller quantity than we had there to start with -- less than half.

Q Do you have any further comment on Exhibit 6-A?

A I might observe it would be my opinion that short of some sort of co-operative flood being worked out across the South line of the lease a good share of that 918 or 919 barrels will be lost forever. I don't believe anybody will ever get it. If I assume that Mobil's flood is carried to its conclusion in this way as shown on Exhibit 6 and our wells finally water out, I don't know what we will do -- whether we will probably plug them -- that is what we ordinarily do.

There will be a corridor 1,320 feet wide between our last

row of production wells and Continental's North row of production wells and the same thing with respect to Marathon -- there will be a 1,320 foot corridor all around the South end of the lease there. That is short of some sort of co-operative flood being worked out where maybe in fifteen or twenty years they finally want a waterflood in the upper zone where they can use some of Mobil's wells to do it with. I think that oil will be lost forever. I don't believe anybody would have a prayer of getting it.

Q Now, refer please to what has been marked as Exhibit No. 7 and explain that exhibit and its purpose.

A Exhibit 7 shows once again -- it is a plat of the same area as the previous exhibit. It shows once again red lines connecting the Southern most row of currently enclosed waterflood patterns on the lease and it shows green lines connecting the additional proposed injection wells that we now request tied into the pattern. It shows colored in green, shaded in green, the area around the Bridges State lease that would not be effectively flooded of its reserves to Mobil. If this application is granted that is the area outside the effective drainage area of the last row of producing wells under the configuration that we propose short of having lease-line co-operation.

Q Well, have you made a calculation using the same

method of reserve calculations concerning the volume of that green area, that is the volume and barrels underlying it?

A I have not done it just that way. I have made some reserve calculations for the South end of the lease. If I could assume that reapplication we are making here today will be approved and will go on with the flood as I propose, then the addition of the enclosed patterns on the South side of the lease together with the one pattern which will be subject to a three-way push and the one pattern which will be subject to a one-way push, the remaining acreage having been enclosed by the injection wells, that probably will recover a total from the South end of the lease of a 1,362,000 barrels. That is the sum of the recovery from all three areas which would result in only 294,000 barrels being pushed outside the control of our producing wells, some of which I should suppose would make it to the lease-line.

Q Well then, in effect that presents a contrast of a loss of or a leaving of some 295,000 barrels as against 918,000 barrels, is that right?

A Yes, sir. It is the difference between Mobil giving up 294,000 barrels of recoverable oil beneath its lease in the configuration set out in Exhibit 7 and 919,000 barrels in the configuration as set out in Exhibit 6.

Q In other words, Exhibit 6 is representing the present

order and its effect and Exhibit 7 is representing the proposal made by Mobil at this time and its effect?

A Yes, sir.

Q Now, you have made reference in the course of describing your calculations and the basis therefore to an Isopachus map. Refer to Exhibit 8 and describe what that is.

A Exhibit 8 is the Isopachus map that I have used for purposes of estimating waterflood reserves over the Bridges State lease including the South end of the lease. Yes, sir.

Q And that data is based on what -- where did you recover the data for the preparation for the Isopachus map?

A The Isopach is based on several types of data. For the most part it is based on well logs. I pointed out earlier that most of the San Andres wells in this area were drilled a long time ago. Starting in the late -- well, I believe the discovery well was drilled in 1927 and development followed that. They were not logged by the methods that are used today. There was usually a sample log available on the wells, sometimes a drilling time log, something of that nature, but no well surveys. Because production has been found in deeper zones in recent years and there has been a lot of drilling going on the last few years to get that production, why, we have recently come into quite a lot of well log data which covers most of the area concerned here. Those logs were generally

the basis for this Isopachus map. There are a few cases where we had core data which corroborated the log data and confirmed the net pay that was present in the upper San Andres. I might also point out that Exhibit 8 is an Isopachus of the upper San Andres and it doesn't take in the lower San Andres.

MR. SPERLING: Mr. Porter, we have got a couple of rather large exhibits to put up. This might be a proper time to take a recess, if you would be so inclined.

MR. PORTER: We will take a ten minute break.

(Whereupon there was a short recess.)

Q Mr. Kelly, you are the same Mr. Kelly who was testifying prior to the recess?

A Yes, sir.

Q At the time of the June 10th hearing, June 10, 1970, at which the matter which is the subject of this hearing was first considered, there was reference to high water production having been experienced by Mobil in the early stages of its waterflood project in the Northern portion of the Bridges State lease. Do you recall that testimony?

A Yes, sir. I offered some of it and I believe there was another witness or two that commented on it.

Q Now, for the record in this hearing, would you please relate what Mobil's experience was in that regard?

A In and around the Pilot Flood -- you can't see any

of it up here now because they are covered up, but in and around the Pilot Flood in Section 14 and 23 and finally in the expanded area which we took into flood in 1967 a good many wells, producing wells, did experience water response. Almost contemporary with water response, in some wells the oil production showed up first and in a month or two or perhaps six months later the water production showed up. In some wells the initial response was a kick of fifty or seventy barrels of oil and fifty or seventy barrels of water per day.

We have recognized this problem from the early time of the flood. It showed up in the Pilot Flood and when we expanded the flood in 1967 it showed up again. It was of interest to us to find the reason for this early water production that was showing up and so we started to analyzing the various data that we had on the wells and we began to see a correlation between early water production and certain characteristics that we could identify in the wells. We have prepared some geologic cross sections that are intended to illustrate what I believe is taking place in those areas where we do experience high water production at an early time.

Q Lets identify for the record what has been marked as Exhibit 9, which I believe is an indication of the line of cross section which will be covered in the course of the

explanation of Exhibits 10 and 11. I believe there are only three copies of that line of section which has been presented to the Commission.

A Yes, sir. We just have three copies of that plat which has been marked Exhibit 9 and it shows the lines of two sections, two cross sections drawn on it. I believe all three of those maps are in the Commissioner's packet.

Q Well, isn't it true, Mr. Kelly, that on Exhibits 10 and 11, which we will get to in a moment, the line of section is shown on the exhibit itself?

A Yes, sir. In a reduced area quad on each cross section the line of section is shown.

Q Well, we will assume that we have established what the line of section is by Exhibit 9 which will, of course, be a part of the official record, and for the purpose of your explanation now of Exhibit 10 would you please refer first to that line of section as reflected on that exhibit and then go to the exhibit itself and explain what it shows with the relation to your previous explanation concerning the experience of Mobil with early water production at some stage in the flood?

A Exhibit A -- I beg your pardon -- Exhibit 10 is a log cross section, AA prime, which extends in an East-West direction beginning on the East -- I beg your pardon --

beginning on the West in Mobil's Bridges State No. 135 and ending on the East in Mobil's Bridges State No. 88. This cross section utilizes five inch logs so as to more amply illustrate the point that I think is significant. The particular wells selected for this cross section were so chosen because we did have logs on all of them and because we had core analysis data on all but two of them.

Plotted on the cross section on each log where the core analysis information is available is the data summary sheet out of the core report. For example, in well No. 135, the core data is plotted along side the well log as it is in No. 78, in No. 74, in No. 79 and in No. 88. The core analysis in each of these wells show an interval of extremely high permeability as compared with the permeability of the rock above and below. This interval of very high permeability on the core analysis coincides with a zone of very high porosity indicated on the well logs. The permeability and what I call the high permeability zone is very high. It ranges up to about 1,700 millidarcies. The main body of the pay I find frequently has a much lower permeability in the order of a fraction to say 25 millidarcies, so the permeability within the high permeability zone is very much greater than it is within the main body of the pay. The pay is sort of thin up on the North end of the lease too. In this case the logs on AA prime section

show that most of the pay is in the high permeability section.

We have colored in red the interval which is interpreted to comprise the high permeability section and in pale green the upper San Andres interval. That is just ordinary pay above five percent porosity. This shows that throughout the East-West length of the section that some portion of the high permeability interval is present.

I might point out that there is a well, Bridges State No. 134, indicated on cross section A prime with a star above it. This star is indicated to show that this particular well is common to both cross sections AA prime and BB prime.

Q What is the average thickness of this high permeability section in there that you have described -- I think you referred to it as being relatively thin.

A Yes, sir. I haven't computed the average thickness. I can see that the upper interval, the red interval on the West end of the section, looks like it is two or three feet in thickness there. The lower red interval is perhaps four or five feet in thickness and you can see by comparison that it maintains that approximate thickness until you get over into Bridges State No. 134 where the upper high permeability zone increases in thickness to about six feet and the lower zone to seven or eight and that seems to follow on through the rest of the way -- seven to generally nine feet in the lower

of the two high permeability zones.

It might also be worthwhile to note that the zone comes and goes. It is not present everywhere. Whereas, it is indicated to be present on the West of Bridges State No. 79 in the upper zone, by interpretation of the log it goes out as evidenced by the core analysis in the upper zone in wells 79 and 88 on farther East, but the lower zone holds up through there and does extend between the wells, I believe.

Q Now, by your reference to upper and lower zone, you don't mean to imply, do you, that this is what you have classified in your previous testimony as the upper San Andres and the lower San Andres?

A No, Sir. I am speaking of the two high permeability streaks that are evident in the upper San Andres interval on cross section AA prime. Sometimes a well will have one of them, sometimes the other. It may even be that some of them will have three such intervals. Sometimes they have none at all. In this case it is the high permeability interval is present over a good portion of the North end of the lease and this simply illustrates that it goes all the way across from East to West on the extreme North end.

Q Now, having made that investigation and having correlated the data that you have described did you reach any conclusion with reference to the conducting of the water-

flood project concerning the early water production that you experienced?

A Well, on seeing data like this set out on exhibit -- on cross section AA prime, I began to become suspicious that this high permeability, however, would provide an extremely conductive zone for injected water. In other words, I would expect any fluid to move through it much more readily than through the rest of the pay. Further study of the well data in the waterflood area itself indicates that in every case where early water production has been a problem that we have something like this high permeability interval indicated from the data that we have.

Now, our core data is pretty sparse on South of the area covered by Section AA prime, but we do have a good many well logs and, of course, we have the original drilling records on the San Andres wells themselves which afford some basis for deviating between quality of pay -- sample logs and drilling time logs and such as that. In every case where we experience the early water production it was evident in the producing well that made the water and also at least one offset injection well that a very porous soft drilling interval was present. I interpreted that this was in all probability the high permeability interval that we saw in the core analysis farther North.

Q Now, would you refer to what has been marked as Exhibit 11 and explain that line of section.

A Exhibit 11 is cross section BB prime which extends in a North-South direction. On the North end it ends with the -- I believe it is now the Marathon State Bridges No. 3. It goes from there to the Bridges State Mobil Bridges State No. 123 which is common to both cross sections and proceeds on in a Southerly direction from there down through the balance of the Bridges State lease. It crosses on to the Marathon lease at this point on to the Continental State H-35 lease at this point and exits on the South side of the Continental lease to the Phillips Hale No. 7 on the extreme South end. The section also shows, as does cross section AA prime, across the top of it, the section which the wells are located in. As you progress from North to South you go from Section 12 to 14 to Section 13 to Section 24 and so on down to Section 35 on the extreme South end.

Q And, again, the line of section as shown on the extreme right-hand portion of the exhibit.

A It is shown on the right, extreme right of the exhibit, yes, Sir.

Q Now, would you continue with your discussion of Exhibit No. 11?

A You can observe once again on the log which is

common to both sections the interval colored red which I described as the high permeability interval. We think it probably extends on up to the North under the Marathon lease and extends to the South from No. 134 down to our Bridges State No. 40. From there the line of section goes to Bridges State No. 107 in Section 13 where almost all of the porosity of this disappears altogether. You might note on the section that the white area left remaining on each of the logs within the colored interval is representative of the tremendous or the magnitude of deflection of the porosity curve and which correlates generally with porosity -- that is the greater the white area and the farther to the left the porosity curve comes, the greater the porosity, so you can see we are coming from fairly high porosity in the first three wells to very little porosity in No. 107 and I view that high permeability streak is gone altogether there; that the best porosity in that well is not very good. It comes out to Section 24, Bridges State 11 -- I can't tell whether that is 113 or 118 -- where this time, by interpretation of the porosity logs, I concluded that the high permeability interval must have come back. This is a very highly porous zone in here and we have got some water production in that area and so I feel it has come back there; that it is present also in No. 114, the next well on the section -- that it is present also in No. 127, the next

well on the section, but that it disappears as we cross between Sections 24 and 26 proceeding South and I don't find that highly porous and I think highly permeable interval present anywhere else to the South.

The porosity is generally pretty skinny in Mobil's wells along this particular section. It improves quite a lot with respect to thickness and some with respect to quality too in the Continental State H-35 No. 8. It is still pretty good in No. 12 and it is very good quality in the Phillips Hale No. 7.

Q Well now, there is a datum reference on the exhibit there indicated as minus 400. Would you explain what that is and then the vertical designations that appear on the cross section and what they are supposed to indicate?

A Well, this particular section was hung on a subsea datum of minus 400 feet and so it shows structure. It shows that the top of the San Andres is higher with respect to the sea level on the South end than it is on the North end, as I pointed out at the outset, that our property is on the North Nose of the structure and the structure comes up as you go South. The color code on the exhibit identifies what I have defined as the upper San Andres porosity in a pale green color.

The Lovington Sand is identified as a yellow color. The lower San Andres porosity is identified in a dark green color

and is found on the bottom of the section. If one were to look at an Iso-cumulative map it could be readily understood when comparing it with this cross section, why, it is most probable that the wells improve in productivity to the South. The wells on the North end which generally comprise Mobil's property have principally the upper San Andres only. The best part of it is in Section 24 and some part in Section 26.

The lower San Andres porosity, which is shown here in Section 24, has been calculated on the logs to be water barren and so, if memory serves me right, has not been tested in this particular area. We have tested the lower San Andres and Bridges State No. 27 several intervals in the lower of this dark green porosity were perforated in succession, beginning at the bottom and coming up, and in each case ending up with a top interval here. After a big frac job on each one of them we were able to get substantially a hundred percent water. We did get a little bit of oil out of the upper-most layer of the San Andres interval that we opened up in No. 27. I believe that well came in from the lower San Andres with twenty barrels of oil and forty barrels of water, but within forty-five days it had been plugged because the water production had progressed to about ninety-eight or ninety-nine percent. It was making one barrel of oil per day when we plugged it a month and a half later.

Q What is the character of the rock as between the upper San Andres as you have classified it and the lower San Andres and including what you have designated there as the Lovington Sand?

A The Lovington Sand I interpret as being generally impervious. It is the interval colored in yellow here. I haven't looked at every log that we have. All of them I have looked at -- I say, all of them that I have analyzed with respect to the Lovington Sand itself indicate to me that the porosity is generally below ten percent and from the experience that I have had with sand in the Permian Basin, I very rarely find one that will transmit any fluid when the log porosity is below ten percent. I think that is probably because the sand has primary porosity and the Permian Basin is usually a silty sand, has a lot of dirt that has come into it and, of course, it has been formed in part by water moving through the rock and dissolving some of the rocks leaving the holes. The interval that I point to on State H 35 No. 8 below the Lovington Sand, colored dark blue, on down to the first porosity, colored dark green, is what I would characterize as generally impervious dolomite or lime. I don't believe there is any likelihood of oil or water or any fluid moving vertically between the light green porosity and the dark green porosity in any of these locations that is outside the well bores which

have come in communication there.

Q Well, has that, the preparation of that cross section and your study of the data represented by it -- have you reached any conclusion as to whether there is communication other than through the well bores as between the upper San Andres and the lower San Andres?

A Yes, sir. It is my opinion that in the area covered by this section which is generally the North end of the Vacuum field there is no vertical communication outside of well bores between the upper and lower San Andres as identified on this cross section. It is also my opinion, based on this section, that the high permeability streak is not present South of Sections 24 and 23 on the Bridges State lease and therefore I do not expect the water channeling problem that we have experienced on the North end of the lease to prevail on the South. I expect a flood of the upper San Andres interval on Sections 26 and 25 which are from this area South; that the flood front will move right with much more uniformity through the rock and will not tend to move and will not tend to finger ahead of the oil bank and result in premature high water production.

Q Well, have you reached a conclusion or formed an opinion as to the affect of injection in wells as proposed by Mobil on the lower portion of the Bridges State lease upon

offsetting acreage lying to the South and East?

A Yes, Sir, I have. In an effort to understand what the risks probably are with respect to an upper San Andres waterflood on Mobil's property bringing some harm to the property to the South -- which in this case are the Continental H-35 lease and the Marathon State McCallister lease -- I might take one of these down so we can look at the map -- I thought it best, I thought the best way to understand, since I feel pretty well acquainted with our own production in here -- the best way to understand what the risks might be, I tried to in particular to analyze the character and quality of production and production history on the Continental State H-35 lease in Section 35 right here. I plotted out the production, recent production on all of the wells, the San Andres wells on that lease, and determined as best I could from extrapolation of the visible declines of those wells what the remaining primary reserves were. I was able, by this method, to determine, in my opinion at least, what the remaining reserves were for all of the San Andres wells on the State H-35 lease exclusive of Well No. 2. Well No. 2 does not show any observable decline in recent years and so I didn't choose to go through any more completion method of estimating its reserve and have not estimated them. I also wanted to form an opinion as to where the oil was coming from that the Continental wells had produced in the past and, of course, these wells were not logged either now but they have been. They have had twin wells drilled

close by to most of them and the twin wells had porosity logs on them from which I could pick the upper San Andres and the lower San Andres porosity that probably are open in each of the San Andres wells. By comparison of the open hole completion interval in each of the San Andres wells with the log porosities in the twin wells I did form some opinions as to the approximate total feet of upper San Andres and lower San Andres and porosity that is or was probably open in all of Continental's wells during the primary depletion up to the present and I have tabulated those picks on a companion exhibit somewhere.

Q I take it that you are referring to what has been marked as Exhibit 12 and companion exhibits to it, is that correct?

A Yes, Sir. Exhibit 12 is titled "Assessment of Past Primary Performance of State H-35 Lease". It has two or three things showed on it. There is a tabulation on the upper part of the page which shows the reported cumulative oil for each of the San Andres wells in thousands of barrels to May 1, 1970. It shows my estimate of the relative portions of that cumulative recovery that I estimate came from either of the lower or the upper San Andres and it shows the estimated pay thickness that I think is probably open in each of those wells in the upper and lower San Andres. I might say that in each case I just took a straight proportion in allocating the production between the upper and lower zones. I just took a

straight proportion of the cumulative relative to the total thickness as it compared with the thickness of one of the other zones.

Q Let me interrupt at this point, Mr. Kelly, and ask you if on a cross section represented by Exhibit 11 any of the logs of the Continental wells as shown on the exhibit which shows the location of them are present. In other words, are there any --

A Yes, Sir. There are two Continental logs on this cross section State H-35 No. 8 which is a twin to the No. 2 well and the State H-35 No. 12 which is a twin to the No. 1 well.

Q Now, show the location of the No. 1 and 2 San Andres wells on the plat where your pointer is.

A Proceeding South in the same order on the cross section the No. 2 well is in the upper Northeast corner of the lease and the No. 1 well is in the lower Southeast corner of the lease.

Q Alright. If you will continue now.

A These logs show the relative thickness of the upper and lower San Andres in total but, of course, don't illustrate, without knowledge of the complete data on the San Andres wells themselves, what portion of the lower San Andres might be open. For example, in Well No. 2 which is twined by this Well No. 8, I estimated there were thirty four feet of San Andres open and only five feet of lower San Andres. My examination told me

that probably only this upper green interval was open in that wellbore. Although that is an illusive thing, the structure does change and the intervals change laterally so you never really know. That is the best I could come up with with comparison of those logs. In the case of Well No. 1, which has as its twin Well No. 12, I estimated that there were fifty six feet of upper San Andres interval open and fifty six feet of lower San Andres interval open in the well so in that case I allocated the production being equally between the two zones. Of course, fifty six feet of upper San Andres doesn't begin to take in all the San Andres porosity. It is just the amount that I thought was probably open.

Q What do you mean by "twin well"? You have made reference to it. How close is the twin to the original well or to the San Andres well that you are talking about that are open hole completions?

A I think by looking at the map that they will range anywhere from a hundred to two hundred feet apart. Some of them look a little closer than others.

Q Alright. Go ahead.

A The second tabulation on Exhibit 12 in the middle of the page is my computation of the depletion status of the upper San Andres on the State H-35 lease if I can assume that my allocation of cumulative oil to the upper San Andres is realistic. When I compared the reported recoveries for each of the wells with my estimate of upper San Andres oil by this

technique that I have described with the oil in place beneath forty acres around each well I discovered that all of the wells would have had to have produced a high percentage of the oil in place initially beneath that acreage. The only well that I calculated to have recovered anything like a solution gas recovery from the upper San Andres on that lease is Well No. 1 which was indicated to have produced 23.6% of the oil in place. I might say that I have analyzed various portions of our Bridges State production in the San Andres and rarely do I find a well that produced more than 24, 25% of the oil in place before it had approached the economic limit. Of course, in the case of Well No. 1, it is way above the limit and I think it has a good amount of reserve left to it.

As we come on down the tabulation it can be seen one well, the No. 6 Well, which by my interpretation over on the West side of the lease doesn't have any lower San Andres open in it and it has produced all of its oil out of fourteen feet of upper San Andres porosity, the allocation that I gave to it, which was reported production, shows that it must have recovered 142.8% of the oil initially in place. I don't believe any of these things happen with the solution gas mechanism. If they had all come up close to 20 or 25% or less I would probably have concluded that my allocations were realistic. I don't believe they were realistic and I conclude that one of

two things must have happened. If the allocations are correct it must follow that quite a lot of oil has moved into the Continental lease in the upper San Andres zone. If the allocations are incorrect it must be that I have allocated much too much oil to the upper San Andres and much too little to the lower San Andres -- in other words, that the lower San Andres must have actually given up a much greater proportion of the oil than I have allocated to it by this straight proportional technique. I have formed the opinion from further study of the data in and around the H-35 lease that in all probability the upper San Andres is in fact pretty well depleted of its primary oil under that lease. I believe if, for example, these wells could have recovered fifty or a hundred percent of the oil in place beneath their drainage patterns, and oil had migrated into them from adjacent tracts to generate that recovery in the past, that it would still be happening at the present. There are two wells on the lease that are either below or close to the economic limit. The two wells on the West side of the lease. No. 4 has been shut in since, as I recall, the early part of 1969. I have a plot of its production here which would show when it was because it is apparently incapable of production. I noticed that it had been treated with -- it seems like it had been treated with acid before it was finally closed in. Also I believe thirteen hundred and eighty pounds of explosives were set off in the bottom of it

last year or it may have been the last of 68 or early 69 and still no oil came out of it. That well has produced all of its oil, primary oil. It is shut in.

Now, No. 6 is currently producing somewhere in the neighborhood of four to six barrels per day which is not really out of line with the production that I see farther on North in areas where I am certain the upper San Andres is pretty well depleted of its primary oil. I know from the data that I have seen on other wells completed in the lower San Andres around here that the lower San Andres is a very prolific reservoir and will give up its oil pretty readily. I had the opinion that the lower San Andres is the place that the substantial majority of the remaining reserves to the Continental State H-35 are coming from and that the upper San Andres is in all probability pretty well depleted of its primary oil.

Q Well, you mentioned earlier and I don't believe you completed your explanation concerning conclusions reached by you to the effect that oil was not migrating onto the lease.

A I believe if oil were currently migrating onto the lease so as to afford a recovery of 140% of the oil in place or 50% or 60% or whatever, that it would still be doing so at the present. The pressure history of the San Andres Field has been pretty flat. It was a low pressure field to start with. It came in originally slightly more than sixteen hundred pounds bottom hole pressure and I believe that the current reports

that after forty eight hour shut-in wells in the general vicinity of the Continental State Hp35 and State McCallister, the Marathon State McCallister and the Phillips Hale will show that it is currently in the neighborhood of six to seven hundred pounds and that over the past several years has been declining somewhere between twenty and forty pounds per year and this would compare with a decline in reservoir pressure down to the vicinity of nine hundred pounds over the first seven or eight years of production for the field, so you can see that since 1945 when the average reservoir pressure was somewhere in the vicinity of nine hundred pounds, that there has been very little dropping reservoir pressure without there having been a substantial drop in reservoir pressure from the prolific areas. It seems to me that the differential must still be there, that the differential must substantially be there and if migration in the upper San Andres had taken place in favor of the Continental lease in the past, it really ought to be doing it at the present time and I don't believe -- I am certain it is not doing it on the West side of the lease and the wells on the East two-thirds of the lease I think have both the upper and the lower zones open, so I can't be certain. I just have the opinion that it is probably a similar condition existing over there.

I was going to say that there is such a good interval of upper San Andres indicated on the extreme East side of the

lease in Wells 8 and 12 that I think it is conceivable that since that is offset also by good stuff to the east and south, that there may be some replacement in there. I don't think there is any oil coming in the lease on the west two-thirds of it in the upper San Andres. I think all the oil that is coming in, if it is, is in the lower San Andres.

Q Well, I take it then from what you have said that your conclusion has been that most of the production being experienced currently from the Continental lease at least is from the lower San Andres, is that right?

A That is my opinion. Yes, Sir.

Q Now, you made reference to production plots in the earlier portion of your testimony while in the course of discussing Exhibit 12. Have you marked those for identification?

A Yes, Sir. Those are the graphs of production of the Continental State H-35 San Andres wells and they are marked as Exhibits 12A through 12F. On each of those exhibits I have shown the extrapolated decline extrapolated that I have used in estimating remaining primary reserves for each of those wells.

Q Did you finish your explanation of Exhibit 12 before we pass on?

A I thought I did.

Q Alright. That is your assessment of past performance of the State H-35. Now, would you refer to what has been marked as Exhibit 12G, please and explain what that is intended

to show.

A Exhibit 12G is just a tabulation of the remaining primary reserves that I have estimated for the State H-35 lease wells exclusive of Well No. 2. Those range from 57,000 barrels as a maximum for Well No. 5 in the South Central part of the lease down to 5,000 barrels for Well No. 6 in the North-west part of the lease and, of course, zero for Well No. 4 which is not currently producing, I don't believe.

Q Alright. Will you refer to Exhibit 12H.

A To further evaluate the risks that I think are involved for Continental in our conducting the waterflood along the South side of the Bridges State lease as we have requested I tried to estimate the volume of waterflood oil that Continental's H-35 No. 6 and H-35 No. 3 would recover as a result of Mobil's injection into the well that we have requested a location for drilling one hundred feet from the lease line South of our well No. 26 and also into Bridges State No. 15 directly North of No. 26. The well that we want to drill for injection South of No. 26 to close up that pattern for Well No. 26 will be, if our permit is granted, 760 feet from the No. 6 well. I have used the data that we developed in a one-way push flood up here in the pilot for purposes of estimating the future oil that these wells should be expected to recover. I have used saturation data based upon the performance of Well No. 26 in analyzing the reserves for Well No. 6 and I have used average saturation

data for the South end of the lease and analyzing the oil that might be pushed to Well No. 3 by injection into Bridges No. 15. I used the average data in that case because No. 15 is also completed in the upper and lower San Andres and it is, of course, one of the best wells we have on the lease and I don't have confidence in any method of allocation between the zones that I have generated so far so I have just assumed in that area at least that the upper San Andres saturation would be the average for the entire South end of the lease. I have generated those calculations by directly comparing with the performance around the pilot and determined that if similar performance is observed between Continental and Mobil's property that the No. 6 well should be expected to produce 5114 barrels of waterflood oil after the drilled well goes on injection. Similarly I have estimated that Well No. 3 should be expected to recover 16,787 barrels of upper San Andres waterflood oil before the upper zone would reach the economic limit in the No. 3 Well.

Q The calculations that you have made with respect to those two wells, that is Continental No. 6 and No. 3 wells, that you have pointed out on the plat there, are contained on 12H to which you have already referred and Exhibit 12I, is that correct?

A Yes, Sir.

Q What do you mean by your reference to reaching the

economic limit insofar as those two wells are concerned?

A Well, at the point where the value of the oil entering into the well on a rate basis declines below the cost of operating the well so as to produce that oil.

Q Alright, would you refer to what has been marked as Exhibit 12J, please?

A Yes, Sir. 12J is a tabulation of some estimates that I have made or prepared on some workover, theoretical workover expenses or investment that would be incurred under different configurations, under different plans. I had these worked up because I know from conversations that I have had with Continental's representatives that Continental is very concerned about the quality of its possible lower San Andres reserve on the West side of the lease and certainly those that appear already to be in evidence on the East side of the lease and so I wanted to be in a position to compare as well as I can the cost of handling the situation by Continental. In the event that our application is granted and we do inject into the upper San Andres and along the South line and Continental's wells along their North line do finally water out in the upper San Andres and leave them with the problem of high water production or executing some sort of a remedial operation to get rid of the water so as to continue producing the lower San Andres reserves, I reasoned that there are a couple of different ways for that to happen. I think it is altogether probable that Continental could, if it had lower San Andres production

in Well No. 6 which had not been demonstrated yet, that Continental could lift the extra water that would come to the well after its waterflood reserves have been produced in the upper zone and in order to keep producing the lower San Andres oil, if it is there. Also another method of control they could elect would be to set a line in the well if it is an open hole completion, if it all happens. In the case of Well No. 6, of course, the estimated oil waterflood oil that I have estimated will come to the well from our injection is 5,000 barrels -- about equal to the remaining primary -- about the same as the remaining primary and so in that case there would be no incremental oil to the well which would, you might say, pay Continental for doing any work on the well. Although it is a possibility that Continental could elect -- if they have confidence at the time they do deepen Well No. 6 -- if they have confidence in the lower zone at that time they can go ahead and set a line then which would cost them about a total of about \$14,000 as compared with a total cost of close to \$18,000 for first completing the well open hole, including the upper and lower San Andres, and then setting a line at a later date and shutting off the upper zone so as to get rid of the water from the upper zone.

In case of Well No. 3, I believe that the upper San Andres reserves remaining in that well are minimal and that in fact the 42,000 barrels that I have estimated remaining

to that well on the primary are, for the most part, coming out of the lower zone, so I think almost 17,000 barrels of oil that I think Well No. 15 would push to Well No. 3 and that would be recovered by it would more than compensate Continental for any remedial measures that they might feel compelled to take. They could either choose to produce the water when it comes in on the well and continue to get their oil in that way -- that would entail higher operating expenses -- or they could set a liner at a cost of some \$9,000 to control the water production from the upper zone. I recommend a lot of investments of \$9,000 to get 17,000 barrels of oil. It looks like a good deal to me.

Q Well now, you have stated on several occasions, Mr. Kelly, that it is Mobil's plan to inject only into the upper San Andres, yet a number of these wells on the southern end of the Bridges State lease are open hole completions in both the upper and lower San Andres. How would you propose to control the injection of water into those wells so as to isolate injection into the upper zone only?

A I have prepared wellbore sketches which show the method that I expect that we will employ if this application is granted to control the injected water and insure that it enters just the upper San Andres. The open hole completions that we have out there right now are Bridges State No. 29, 15 and 25. The other wells that we are asking for authority to inject

into are case hole completions and some -- in those cases -- in the case of the case hole completions we will either set a bridge plug or plugs or perhaps a cement plug opposite or above any perforations that are open currently to the lower San Andres so as to confine the water to the upper San Andres. In the case of the open hole completions I think we would probably plug those wells back with cement which would generally come a hundred or so feet above any lower San Andres porosity and in this way I think we will be able to control, insure that the water doesn't enter the lower San Andres.

Q Well, I take it from what you say that Mobil is willing to forego whatever contribution there might be from the lower San Andres to Mobil's wells by that method?

A Yes, Sir. At this time we are willing to give that up. We have got an awful lot of money tied up in this water-flood and the order we are operating under now costs us an awful lot of oil we were counting on getting when we made this investment and we have got to flood the South end of the lease to make it -- to afford the investment, to have integrity. I believe we can do it without harming our neighbors.

I haven't commented on the Marathon lease. I might observe here that the colors somehow got changed between these two exhibits and Marathon suddenly became orange on this exhibit and here it is purple again. Marathon's wells are, according to my understanding, except perhaps with exception of

Well No. 2 -- and I don't know what its situation is -- all equipped with liners. Sometime back they, after having produced the upper and lower San Andres and having had very good wells there, they are indicated to have gone into those wells and set liners isolating the zones from each other; perforating the lower San Andres only and treating and putting the wells back on production. The producing ability of those wells is generally at least equal to top allowable at the present time and I don't know how much greater it might be. That is just from the lower San Andres only except for Well No. 2. There was a paper filed with the Commission indicating plans to work over Well No. 2 in much the same way that the other wells had been worked over, but I never did find a report in the Commission's files indicating the work had actually been done. About the time that the report was filed I did notice that the producing characteristics of the well seemed to change. As I remember, it started making a little more oil and quite a lot of water about that time but the production curve would have to speak for themselves on that so I don't know whether Well No. 2 is still producing open hole or is producing with a liner and the upper zone shut off.

In the case of the other three wells, No. 1, No. 3 and No. 4, those wells are producing just from the lower San Andres. The upper San Andres is isolated behind the pipe. I believe that any injection that Mobil would undertake in the

area offsetting Marathon's property would be -- that that injection would have a low probability of pushing any oil off of their lease so long as -- in fact, I don't believe that the water front would invade on the lease to any significant extent so long as Mobil continues to produce its wells as we expect it to do and so long as Marathon has the upper zone shut in. The water, the injected water is going to move to the areas of lower pressure and I think with the upper zone shut in on the State McCallister lease right now, that that has got to be a higher pressure area than the areas surrounding it which are indicated to be open in the upper San Andres. As long as Marathon doesn't produce their upper San Andres zone I don't believe that there is going to be any significant entrance of water on that lease. I think, on the contrary, that the water would move preferentially towards the areas that are voiding production from the upper San Andres, that is back towards Mobil's producing wells.

Q I believe you did identify Exhibit 13 as being diagramatic well sketches which show the proposed completion methods for the wells which are the subject of the application for conversion to injection, is that correct?

A Yes, Sir. I have marked Exhibit 13, a package of wellbore sketches, which show the intended completion method that we expect to employ on these additional injection wells if our application is granted.

Q Mr. Kelly, I think I have neglected to ask you when you were talking about Exhibit No. 11, the vertical separation in distance in feet as between the upper and the lower San Andres on the lower portion of the Bridges State lease and the lease to the South of the Bridges State lease; what kind of a vertical interval do we have in there?

A On the South end of the Bridges State lease, that interval which I identify as generally an impervious barrier to communication, covers an interval generally between two and three hundred feet in thickness between the porosities in the upper and lower San Andres. I see here that in the Continental State H-35 No. 8 it is about two hundred feet. It is also about two hundred feet in the State McCallister No. 8 and over in Mobil's Bridges State No. 105, it comes up to -- well -- a little over two hundred feet. It is quite a wide separation.

Q What is Mobil's total investment to date in the waterflood project in the San Andres?

A Our investment just in waterflood facilities on this San Andres flood is close to two million dollars at this point -- about 1.9 million.

Q Do you have anything further?

A Not that I can think of, Sir.

MR. SPERLING: Mr. Porter, at this time we'd like to offer Mobil's Exhibits 1 through 13, including the alphabetical designations referable.

MR. PORTER: If there are no objections, the exhibits will be admitted.

MR. SPERLING: For the record, Mr. Porter, I'd like to have included as a part of it the Waiver of Objection from Phillips Petroleum concerning Mobil's application; Phillips operating the West Half of the North West of Section 35 in 17 South, 34 East.

MR. PORTER: No objection. This will be admitted.

MR. MORRIS: If the Commission, please, at this time, in behalf of Marathon, I'd like to move that this case be recessed and continued until the next Commissioner Hearing that is -- I mean, the next regular hearing of the Commission in October, or, if the Commission sees fit, to the regular hearing that would be held in November. As grounds for a motion for continuance I'd like to state that the evidence that has been presented here upon the direct presentation of the applicant is contrary to its application in this case and is contrary to and differs substantially from anything that Marathon Oil Company was led to believe to be presented as the applicant's position in this case. We are entirely taken by surprise by the position that is being taken here. The case that we have presented both for our direct examination and for the case that we have presented for cross examination of Mobil's witnesses have been directed to what we believe to be the issues in this case. We now find that those issues are changed and we

would be substantially prejudiced unless this case is continued for at least a month and we are given ample opportunity to prepare to continue in this matter.

MR. SPERLING: I think I have already stated Mobil's position with reference to that. I really can't understand what prejudice has accrued to Marathon as a result of the presentation here today. The situation as I see it has changed very little except for the granting of several concessions insofar as Mobil is concerned in the possible effect upon Marathon or Continental, for that matter, and I think it is perfectly in order to proceed. It is the same oil field. It is the same horizons we are talking about that we have always talked about and since this matter was originally filed and I think we should have some demonstration of the degree of prejudice or what constitutes the prejudice other than the statement that it exists.

MR. KELLAHIN: Commission, please, I wasn't aware that the applicant admitted concessions insofar as Continental is concerned. I think we are in the same position we were, however, we do feel that the continuance should be granted at the request of Marathon because of the change of the nature of the application insofar as they are concerned.

MR. PORTER: Gentlemen, we won't rule on this motion until 1:30. We are going to recess the hearing at this time until 1:30 and, in the meantime, there is at least one attorney

here, I believe, that will be involved in the case upstairs that the Examiner is going to hear during this recess.

(Whereupon the hearing was adjourned for lunch.)

MR. PORTER: The hearing will come to order, please.

The first order of business, Mr. Morris, will be to deny your motion for a continuance, so we will proceed with the case. Mr. Kelly is available for cross examination.

CROSS-EXAMINATION

BY MR. MORRIS:

Q Mr. Kelly, first I would like to make sure that I understand definitely what the status of your present application is to the Commission. First, with regard to your Bridges State Well No. 14, is the proposed injection well in the Southwest Quarter of the Northeast Quarter of Section 25 -- I take it from the diagramatic sketch included within your Exhibit 13 that injection into this well will be through perforations from 4470 to 4563.

A Yes, Sir. That is correct.

Q Now, does that confine the injection entirely into the upper San Andres zone?

A Yes, Sir, upon the Lovington Sand.

Q And what rate of injection do you plan to use into that well?

A Most probably whatever the well will take. We will attempt to get a thousand barrels a day into it at the outset.

The experience that I have had with other wells in here indicates to me that over a period of two or three months a well that starts out taking a thousand barrels a day will likely be down to five hundred barrels per day or less. Down in this area, the area of Well No. 14, I will be very pleased if we are able to maintain as much as five hundred barrels per day injection into the well.

Q Now, initially what pressure do you intend to apply to the injection in this well?

A As much as two thousand pounds at the wellhead, if that is required.

Q Do you intend to maintain this pressure regardless of the amount of water that the well is actually taking?

A No, Sir.

Q If your capacity at the well produces to from a thousand barrels a day to five hundred barrels a day, would you maintain or increase that pressure?

A Over a period of time I would expect to increase the pressure as necessary to maintain a balanced flood. It all depends on what the other wells in the pattern take also -- up to a maximum of approximately twenty five hundred pounds. Our system is designed to handle twenty five hundred pounds. It is a fact that it is impossible to get that much pressure out the wellhead because of the line losses and so on. On the North end of the lease where we are operating our flood currently

we are able to get up to about twenty four hundred pounds at the wellhead and I expect that this will be about the same experience we have on the South end.

Q Moving West over to the Bridges State Well No. 13, -- wait a minute -- first on your Bridges State Well No. 14, what you are proposing varies from your original proposal for injection as presented by your original application in this case, does it not?

A Yes, Sir. In referring to the sketch of Well No. 14 you can see that the well is bottomed at 4803 feet. It is a fact that at the present time all the perforations that are in this well are open to the wellbore including the open hole interval that extends from 4763, the casing show, down to 4803. We are currently making quite a lot of water out of that bottom zone which includes the perforated interval from 4750 down to the total depth of 4803.

Q Now, your original application --

A At such time as our application might be approved I would expect that we would recomplete the well consistent with the wellbore sketch offered here and inject only into the upper San Andres.

Q Alright, so your proposal to inject into the perforated interval from 4470 to 4563 differs from your original application which was to inject into the open -- all of the open perforations and into the open hole down to 4803?

A Yes, Sir. The top of the previously proposed injection interval was 4470, the uppermost perforation, and the bottom of it was 4803, the total depth of the well.

MR. PORTER: Is that in Well No. 14?

MR. MORRIS: Yes, Sir.

Q Alright, moving West over to your well, your Bridges State Well No. 13, now, in your original application to the Commission you had proposed drilling a new well.

A Yes, Sir. I had proposed drilling a new well three hundred thirty feet closer to Marathon's lease line in Well No. 13 as at the prior hearing for the purpose of injecting into the entire San Andres pay interval. That assumed, of course, that we might pick up some lower San Andres pay in the well. At the present time that portion of the application has been modified; that is we have retreated from that proposal to a request to inject into Well No. 13 into the upper San Andres interval at such time as Well No. 13 depletes its Blinbry reserves and becomes available for injection into the San Andres.

Q So your application now -- well, your original application was to drill a new well for injection. Your application now is to convert this Bridges State Well No. 13 from an injection well -- excuse me -- from a producing well to an injection well?

A From a Blinbry producing well to an injection well with the San Andres. Yes, Sir.

Q Alright, there was nothing said in your original application or in the notice that was given to this hearing with respect to conversion of this Well No. 13 to an injection well, was there, Mr. Kelly?

A I have read the notice and I don't recall any such mention of it. No, Sir.

Q Now, the manner in which you propose to convert this Well No. 13 to injection would confine the water to the upper San Andres zone entirely?

A Yes, Sir.

Q And that would be through the perforations as shown on the exhibit 13 of 4433 and 4449?

A Yes, Sir. That is the interval in which our geologist has identified upper San Andres porosity, at that location, and that is the interval that we would plan to open up and inject into.

Q Is it your testimony that injection into that interval will confine the water to the upper San Andres zone?

A It is my opinion that it will. Yes, Sir.

Q Alright, moving on up around the lower tier here of the injection wells we come to Well No. 25. That is the Bridges State Well No. 25 which is a direct offset from Marathon's acreage, a direct offset to its Well No. 4. What is your proposal with respect to this well?

A To convert it to injection in the upper San Andres.

Q Now, the diagramatic sketch that you have shown in Exhibit 13 shows a total depth of this well of 4,750, a plug back total depth of 4600.

A Yes, Sir.

Q Would injection in the open hole at the 4600 foot level confine water to the upper San Andres?

A It is my opinion that it would.

Q You don't feel that that level is a -- would place water into the lower San Andres as well?

A I think there is very little likelihood that that can happen.

Q You think there is some likelihood that that would happen?

A I think anything is possible. I am certain that the 4600 plug back total depth indicated on this diagramatic sketch is in excess of one hundred feet above the uppermost lower zone and porosity that is in that well and I think it is very remote that a one hundred foot cement plug will break down, although I think it is a possibility.

Q Is this Well No. 25 shown on any of your cross sections?

A I don't remember whether it is or not. Yes, Sir. It is on cross section BB Prime.

Q Excuse me.

A I say 25 is on it. That is not correct either. The

twin wells are. 25 is on that cross section number 99.

Q Alright, and your proposal for this well at the present time differs from your original proposal in that your original proposal was to inject in the entire interval down to the 4750 total depth of the well?

A The original proposal was with respect to Bridges State No. 25 and all of the other injection wells that were omitted from the order that we had asked for injection authority in encompassed all of the oil bearing zones that we had or could find in the San Andres formation. It is a fact that at the time of the June 10th hearing the No. 25 well was jumped in the bottom of the hole and the lower San Andres was not available to it. Also the lower San Andres had been plugged off very nearly at the time of completion just a short while after the well was initially drilled in 1938 or 9 and it wasn't open in the wellbore then. It is open in the wellbore now and if we are granted authority to inject into this well we expect to set a cement plug in the bottom of the well and inject into the upper San Andres. That would be the same with all of our open hole completions that penetrate to the depth of the lower San Andres porosity on the south line of the lease.

Q You gave some pressure and information concerning the volumes of water that you would propose to inject into the Well No. 14. Would that same testimony apply equally to Wells 13 and 25?

A Let me say that the figure that I gave you with respect to No. 14 is an order of magnitude that I am in a position to give you right now. Ordinarily I try to design injection rates based upon reservoir volume in the pattern and I would, based on the isopach map, calculate some volume for each well that we tried to put water into them at the outset. I haven't calculated those volumes for any of these wells as yet and I can just speculate whether I -- I don't think it would run over a thousand barrels a day. I will be tickled pink if we can get five hundred barrels a day into it.

Q Is there a possibility it might run over a thousand barrels?

A I think anything is possible.

Q That is part of the variables involved in your making these calculations, Mr. Kelly. Why is it not possible to tell the Commission at this time what amount of water and what rate of injection you propose to use?

A I just haven't made the calculations. It takes some time to do it and I haven't done it.

Q Do your calculations vary depending upon the reservoir characteristics you find existing in the different -- from well to well?

A They differ from well to well in proportion that the reservoir volume surrounding each injection well bears to the

reservoir volume surrounding other wells in the pattern. The attempt -- my attempt in designing injection rates in a waterflood is to inject sufficient water into each well to flood out all portions of the pattern at approximately the same time so I must use principally the reservoir volume in each pattern for purposes of making this designed calculation. In practice we are seldom able to match those volumes in waterflood and usually end up injecting quite a lot less than we'd like to.

Q These same characteristics that you deal with in designing your rate of injection also determine how fast the floods move through the reservoir?

A The rate at which the wells take the water do determine -- and the water enters the pay --- do determine the velocity of the flood front, yes, Sir.

Q And they would determine the rate at which water would encroach upon the Marathon acreage.

A It would be proportional to the injection rate, I think, yes, Sir.

Q But you haven't determined that at this time. You don't have that information available.

A The best thing I can tell you at this time is, as I have stated, that I'd estimate the maximum rate would be the order of one thousand barrels per day and I will be real pleased if we can get five hundred barrels per day in them. We have a lot of wells farther North that won't take five hundred barrels per day -- a good many that won't take appreciably over a

hundred barrels a day.

Q Mr. Kelly, you gave us your version of your understanding of the state of completion of four Marathon wells involved here and that they are producing through a liner entirely from the lower zone having been deepened and completed in the lower zone. Is that essentially your testimony?

A I don't recall making any direct comment with respect to the stage of completion. I think I did say that all four wells on the lease, it is my understanding, have been produced for a good many years since their original completions as open hole completions and that the open hole intervals in those wells encompassed both the upper and the lower porosity or some part of the lower San Andres porosity. I have examined reports filed with the Commission to satisfy myself that at least three of the wells on that lease have been equipped with liner, as I testified, and perforated just in the lower San Andres. I didn't find a report that indicated that any work had actually been done on Well No. 2, although I did notice, in examining its production history, there was a significant change in production characteristics for the well at about the time the notice of intention to deepen and recomplete was filed.

Q From your study of these wells did you note that Wells 1, 3 and 4 are top allowable wells?

A Yes, Sir. I believe they are. I believe No. 2 is showing a decline. The water cut seems to be picking up.

Q No. 2 is very close to being a top allowable well

at the present time, is it not?

A I would have to look back at the production data to be certain, but speaking from memory I would say that well, with a seventy barrel per day allowable, it is probably delivering somewhere in the neighborhood of forty to fifty five barrels per day reported production.

Q You testified earlier that the upper and lower portions of the San Andres are considered by the Commission as being one pool for purposes of completion and for purposes of assignment of allowable.

A I don't believe I said I knew how they considered it, I know it is regulated as a single reservoir, as a single oil field.

Q Yes. At least with respect to Marathon's top allowable wells on its lease it would not be possible for Marathon to increase its productivity, its production, excuse me, from these wells even if they were to open up these wells in the upper zone at the present time, would they?

A I doubt whether the productivity of the wells would be increased very much, if any. That is just an opinion.

Q Well, you have talked here, Mr. Kelly, about if you were permitted to -- if your application is granted in this case, that, if I understand your testimony correctly, that Marathon would receive the effect of the injection of water into the upper zone and that it would be in a position to produce oil from the upper zone and its wells.

A I don't remember commenting in any such manner, Sir. I believe what I said or intended to say was that as long as Marathon is not withdrawing from the upper -- is not producing from the upper zone, which I have reason to believe Marathon is not doing at the present time -- at least three wells and perhaps four -- that I do not believe there will be any significant encroachment of water onto Marathon's lease as a result of the granting of Mobil's flood. In any event, the granting of Mobil's flood application would result in the pushing of some oil off of Mobil's lease towards and at least onto Marathon's lease -- certainly onto Marathon's lease if the water front ever advanced to the lease line.

Q If your application is granted you would expect water from your injection wells 13 and 14 to advance toward and onto Marathon's lease within a reasonably short period of time, would you not?

A No, Sir. I think that is the opposite of what I testified to; that in fact it is my opinion that as long as Marathon is not taking any oil out of those wells, or any production out of the upper zone, that the water, the injected fluids will be much more inclined to move in the other direction toward the Mobil producing wells than it will be toward the Marathon lease and that if in fact the water ever does encroach onto the Marathon property from Mobil's flood that it would be preceded by waterflood oil which would serve to in-

crease the oil saturation in the upper zone beneath Marathon's lease and I just don't believe that we can inject long enough there and keep our own flood going long enough, as long as Marathon doesn't produce the upper zone, to flood any oil off the lease. I really don't think there is any likelihood of a water bank ever reaching one of Marathon's producing wells in the upper San Andres as long as they don't produce it.

Q Let's take for example Marathon's Well No. 4 which under your proposal would be a direct offset to your injection Well 13 on the North and your injection Well 25 on the West. How far away from Marathon's lease line is your Well No. 13?

A Approximately six hundred sixty feet.

Q The same would be true for Well 25?

A Yes, Sir.

Q And it is your testimony that the injection of water at the rate of up to a thousand barrels a day under two thousand pounds pressure would not cause water to move onto to Marathon's lease and as far as that Well No. 4?

A I think my testimony was to the effect that I had hopes of gaining as much as a thousand barrels per day at the injection rate in these wells although with specific regard to Well No. 13, I don't believe there is a chance we will ever approach that because the pay is so thin and of such poor quality in that well by the available logs that we have. I also indicated that if we were able to achieve an injection

rate of such magnitude that I didn't think -- I don't believe that it would last longer than two or three months at the most. I believe that within a period of two or three months our injection rate on any of these wells that are able to take as much as a thousand barrels per day, on the first day we'll be down to five hundred barrels per day or less and I don't believe the injection program that we will be able to carry on there under two thousand pounds wellhead injection pressure or twenty four hundred pounds wellhead injection pressure will result in any water bank intruding to the vicinity of any of Marathon's producing wells on that lease unless and until they produce the response fluids out of those wells, out of the upper San Andres.

Q Do you have any information on what the bottom hole pressure was on the Marathon No. 4 at the time it was worked over by Marathon?

A I have looked at a lot of pressure reports, Sir, and I don't remember whether I have seen one on No. 4 or not. I believe I have seen more than one pressure report on Well No. 1 in the Southeast corner of the lease, but I don't remember whether I have seen any one on No. 4.

Q Do you know whether the wells were pumping at the time they were converted?

A I really don't know. I assume they were. Most of the wells out there are pumping wells. I believe the new

potentials on the three wells that were worked over, that workover reports were submitted on, were completed pumping. Their potentials were reported as pumping potentials after the workover.

Q Mr. Kelly, in your work with this project have you studied the effect of water injection in other portions of the field with a view toward seeing how fast breakthrough will occur from injection well to producing well for a certain period of time?

A Yes, Sir. I have looked at quite a lot of that information and, as I testified at length this morning, I made a lot of investigations into those water breakthrough problems that were encountered.

Q Generally speaking do you state that your experience in this field that you had experienced breakthrough in approximately a year to a year and a half?

A I don't have the data in front of me and I will have to speak from memory, but I think that in the wells where we have had severe water problems that, yes, the time that water showed up in the producing wells was somewhere between twelve and twenty four months after injections had started into the offset wells. I think that is always just a general statement. I know that it has proven definitely true in some of the wells in the expanded area. Of course, around the old pilot, we injected under low pressure and at low rates for a long time -- well, five years, almost -- before expanding it

in 1963 and there was quite a lot of water out in the rock at that time which moved pretty fast once we kicked up the injection rates and pressure.

Q You made a comparison, Mr. Kelly, in connection with the work you did on Exhibit No. 5, where you studied the losses that would occur where you only have a one well push compared with other types of where you had two or three or a four well push and then you transferred the results of that study. You assumed that the results of that study would also apply not only in the area of that reservoir up in Sections 14 and 23, but you assumed that would apply equally down here in Sections 25 and 26. Now, wouldn't you also have to assume that your reservoir characteristics so far as breakthrough of water on injection are concerned would be about the same up in those same sections as compared with Section 25?

A Not necessarily the economic limit where those wells around the pilot where those wells were reached because they quit making oil and that is what the reserve estimates are made on. I might add, if you had a chance to look at the curve by now, you can see that as soon as we expanded the flood and got the pilot back we were able to get the flood front back into the wells and are enjoying fairly decent oil production even though there is a lot of water production with it.

Q Would you agree with me, Mr. Kelly, that there are reserves in the upper San Andros zone lying, underlying

Marathon's lease?

A I accept that there are.

Q Well, all four of these wells were producing from the upper San Andres at the time they were worked over, is that correct?

A Would you just inform me if No. 2 was worked over too?

Q No. Excuse me. Just a moment. I will see if we can get rid of this hypothetical we have been laboring with. Alright, I am informed, Mr. Kelly, and I will ask you to accept that Well No. 2 also has been worked over in the same manner.

A I accept that there are reserves or most probably reserves in the upper San Andres beneath the Marathon tract. I think there are upper San Andres reserves every place in here where it has produced in the past which it takes in the Bridges State lease, the Continental State H-35 lease and also the State McCallister lease. I do recall noting, though, that at the time that the four Marathon wells were indicated to have been completed open hole in both the upper and lower San Andres during most of their producing lives and that at the time the wells were deepened into it that additional lower San Andres porosity was opened in the wells, liner was set and the wells stimulated in the lower San Andres and that the oil production picked up, so they produced more oil. That logic

would not follow through by itself. They actually produced more oil after they got just the lower San Andres opened and they did when they had both of them open at a higher producing rate.

Q Referring to your Exhibit No. 8, where did you get the information as to the net pay in the wells shown on the Marathon lease that furnished the information from which this isopach map was prepared?

A First let me say that these picks of net pay were in general reviewed by me but I didn't make those picks. I can say, without having examined the data closely myself, that I feel reasonably sure that the net pay picks on the Marathon lease was on the basis of the well logs of twin wells to the San Andres wells. There have been twin wells drilled near by each of the Marathon and San Andres wells on that lease and the logs formed the basis of net pay picks.

Q Do you know what cut off porosity was used in making these picks?

A It was our intention to use a 5% cut off and this map is intended to reflect net thickness of 5% or greater porosity.

Q If you used a cut off of say 3% rather than 5%, your isopach would look considerably different than this?

A I don't know how different it would look, but I assume that it would look different. Three percent is a

lower porosity. If you use that cut off, it follows that in all probability many of the wells have a greater net pay thickness.

Q Even using your five percent figure, this exhibit shows a considerable amount of net pay in the upper San Andres underlying Marathon's tract, does it not?

A Yes, Sir. I think it has got a good bit of upper pay underneath it.

Q And based upon the actual production that has been experienced from this acreage up to the present time would it be reasonable to say that there is still considerable production as yet unproduced from the upper San Andres underlying Marathon's tract?

A I don't know if I would go that far, Sir. I really have not analyzed the upper and lower San Andres production on the Marathon tract as yet in the same way that I have with the Continental tract and I really don't have any opinion in that regard. I did notice, as I pointed out before, the productivity of Marathon's wells improved after they were completed just in the lower San Andres, so I don't know whether the upper San Andres would give up very much additional primary oil or not. It might do it.

Q Have you made any -- given any consideration at all to not only the remaining amount of primary oil available on this lease but also the amount of secondary oil that might be produced if secondary operations were commenced at an optimum

time?

A I haven't estimated the secondary reserves for the Marathon lease.

Q If I understand your testimony, Mr. Kelly, you are proposing to inject water into the upper San Andres formation in three wells immediately offsetting Marathon's lease but you haven't made any calculations or given any consideration to the amount of reserves that are still remaining under Marathon's lease in the upper San Andres formation. Is that your testimony?

A I think in a sense that would be a fair statement. I will clarify my meaning on it. Because I don't believe there is any likelihood that Mobil's waterflood under the circumstances that I have described is going to result in any oil being pushed off of Marathon's lease in the upper San Andres. I believe that whatever reserves are there right now, secondary reserves, will be there whenever Marathon gets ready to flood the lease in addition to whatever Mobil has pushed to Marathon as long as, of course, Marathon does not withdraw production from the upper San Andres as is the case at the present time. If Marathon does withdraw production from the upper San Andres I would expect that Marathon would get a portion of those waterflood reserves at that time and then at such future time as Marathon might be able to engage in a cooperative flood with offsets because I don't think you can flood that one hundred

sixty acres efficiently without cooperation. I think the reserves would still be there to produce. I don't believe there is any loss in upper San Andres reserves that would be incurred by Mobil's waterflood. On the contrary, I think that the greatest likelihood that those reserves would probably be increased by our waterflood -- that is the oil saturation beneath the lease would be increased.

Q Are you assuming that there is any kind of a pressure barrier or any other kind of barrier that is going to keep the water from your injection wells from coming onto the Marathon lease?

A In a sense, yes, Sir. As I stated, the water will move toward the area of lower pressure. Now, I have no way of measuring pressure profiles between injection wells and production wells and knowing at what point the pressure falls to what level, but I do know that it is our intention to produce every barrel of fluid that enters our producing wells and this is what we have been successful in doing so far in our waterfloods. If we continue to be successful in doing that, as I expect us to be, I think the water that we inject will tend to move preferentially toward our producing wells. As long as Marathon doesn't withdraw anything from the upper zone I think the likelihood is slight of very much flood moving in that direction.

Q Isn't it indisputable, Mr. Kelly, if you are inject-

ing water into your injection wells at a rate in excess of a thousand pounds and our wells down here in the upper zone are considerably lower than a thousand pounds pressure, that whether those wells are being produced or not, that you are going to have movement of water from the injection wells down onto the Marathon lease?

A My opinion is that that movement would probably -- yes -- I think this is a reasonable statement which I am going to clarify my opinion on it. As long as there is an ample gas saturation I think the flood will move pretty fast until the gas saturation is filled up. Then I feel like there is going to be ample resistance encountered to further flow, that is unless there are withdrawals taken from it. I think that the pressure differentials, while they will still be in that direction will be much greater in the other direction and the predominant flow of the water will be towards Mobil's wells and not towards Marathon's lease and I haven't estimated the magnitude. It is just an opinion that I have.

Q Gas saturation varies with the pressure?

A And oil that is there to fill it up, yes.

Q What bothers me, Mr. Kelly, is that you are stating as a definite opinion that this water is not going to move down on to Marathon's lease, yet you have admitted that you have made no study of the production that has occurred in the upper San Andres from the Marathon lease or the existing pressures

in the upper San Andres on the marathon lease.

A Well, I don't believe there have been any recent measurements of pressure in the upper San Andres on that lease.

Q So when you say that the water is not going to move onto the Marathon lease, this is just a conclusion you'd like to reach, isn't it -- you don't really have any basis for that without having made a study of the upper San Andres formation on the Marathon lease itself?

A I disagree, Sir. As I have stated over and over, I believe that the injected fluid will move preferentially toward the areas of lower pressure which in my opinion will be in those areas where fluids are being produced and withdrawn. I cannot conceive of there being a pressure sink in the upper San Andres in the vicinity of Marathon's lease since they are not withdrawing anything from it. My opinion is just based on those facts, knowing that Marathon does not produce its upper San Andres. My opinion is that the pressure differentials at this time are away from Marathon and that if any fluids are being moved, they are probably moving away from the Marathon lease onto the adjacent tracts because the adjacent tracts are removing fluids from the upper San Andres.

Q Wouldn't you agree with me, Mr. Kelly, that water is going to move onto the Marathon lease eventually and that what we are talking about here is a matter of time until water has flooded out the upper San Andres zone at least in Wells Nos 2

and 4, if not all four of them?

A I am sorry, I don't follow that question.

Q Alright. Let's come back and just talk about No. 4. Isn't it just a matter of time until well water from Wells 13 and 25 are going to flood out the upper San Andres zone that is available to the Marathon Well No. 4?

A Yes, Sir. I think it is a matter of time and injection volumes, yes. I don't believe that the time that I expect this flood to operate, which is the order of fifteen years, I don't believe that within that time, unless Marathon recompletes those wells and begins to withdraw out of the upper San Andres, that any such condition would occur. Of course, to the extent that while I say anything is possible, to the extent it would occur if it did occur, Marathon would have recovered some incremental oil sooner than they would have got it otherwise, assuming that in fifteen or twenty or thirty years, whenever Marathon gets around to it, a cooperative flood could be operated on that lease with the adjacent properties.

Q Mr. Kelly, assume with me for a moment that Marathon really has not agreed with your opinion on this and I assure you that this is a valid assumption that you can make; that there is a difference of opinion on how fast the water is going to come toward this No. 4 well. If water encroaches toward that No. 4 well and Marathon is making top allowable from the lower San Andres in that well there is no way that Marathon can protect its correlative rights in the upper San

Andres portion of the reservoir by producing the oil that is being swept past that well --if you make that assumption --

A I don't know to what extent I am entitled to have an opinion on correlative rights. I will say this, though, that in such event as Marathon would open up the upper San Andres in the No. 4 well and produce waterflood oil that was pushed to them by Mobil's waterflood, I think, yes, that would represent incremental oil to Marathon, but I agree that it would not represent an increased recovery rate. There would be no incremental rate but there would be incremental oil as long as the allowable controls the well production and as long as it can deliver the top allowable. Certainly there is no incremental rate, but there is incremental oil and extra oil recovered.

Q Just one other point and I will switch off to something else, Mr. Kelly, but if Marathon cannot recover the oil as it comes by, not only is waste occurring, but our correlative rights are being impaired. Now, can't we agree to that -- doesn't it come down to that and that you are saying that that won't happen because water is not going to encroach on our lease and we might have different opinions -- isn't that what it boils down to?

A I think the likelihood of water encroaching materially on Marathon's short of the upper San Andres being produced on that lease is very slight. Yes, Sir. I don't know how to answer the rest of your question. If you care to state it over,

I'll take a shot at it.

Q I think that is enough.

MR. PORTER: I think he knows the answer anyway, Mr. Kelly, probably.

Q Mr. Kelly, have you given any thought -- has Mobil given any consideration to recompleting any of your San Andres wells located adjacent to Marathon's acreage, either deepening or recompleting them in the lower San Andres in a method similar to the method that was utilized by Marathon on its four wells?

A Well, I'd have to say yes. We have given consideration to that and various other possibilities. The fact is that because of some work that had been done years ago in attempting to get some oil out of the lower San Andres on the Bridges State lease a lot of our people had in fact condemned the lower San Andres as being non-productive and when going on the cross sections, I made some reference to Well No. 27 as having been perforated and fraced in several lower San Andres porosities and really never making any commercial oil, we have even tried once again to get some oil out of the lower San Andres since our application was in part rejected pursuant to the June 10th hearing and we ran in and set a packer above the bottom perforations in Bridges State No. 14, which it is my view it is perforated in the lower San Andres and completed in the lower San Andres porosity and we, for three or four days, made twenty

four or twenty five barrels of oil a day out of that zone with sixty to seventy barrels of water. That production of twenty four or twenty five barrels a day lasted for four days. For the following month it averaged five barrels a day and approximately eighty barrels of water. My opinion is that at least at that location there is no commercial oil in the lower San Andres.

Q Which well was that?

A That was 14. There is some oil in it, obviously. We got some out, but I don't believe there is any commercial oil there for Well No. 14. We had a little better luck with Well No. 25, if the production holds up. I don't remember whether I said anything about it at the earlier hearing, but it is true that Well No. 25 was drilled initially to a total depth of 4750 feet and had a good section of lower porosity open in it. It made five barrels a day of water and whoever was looking after the well at the time didn't like the water production and filled the bottom of the well with cement and so shut off the lower zone. Within the past recent time period we have succeeded in getting that lower zone opened up again. I believe it had picked up a little bit of oil production. We got forty, forty two barrels of oil the first twenty four hours out of the combined interval in that well along with quite a bit of water. Of course, there is a lot of load water lost in the well, so I don't know whether it is load water or San Andres

water that we are producing, but, yes, I think in three wells on the Bridges State lease we have a pretty decent chance to make some lower San Andres oil and those are at the locations of 25, 12 and 15. All three of those wells are now completed in the upper and lower San Andres.

Q Now, if your Well No. 25 -- is that the same well that you are now proposing to convert to an injection?

A Yes, Sir.

Q Have you abandoned the idea of possibly converting some of these wells adjacent to Marathon's lease to producing wells in the lower San Andres at this time?

A No, Sir. The three wells that I named, 12, 15 and 25, are currently producing from both the upper and lower San Andres. At such time as we convert either of those wells 15 or 25 to injection by cementing off the bottom of the well, it will be necessary for us to drill the replacement well to get those lower zone reserves.

Q When you talk in terms of having a cooperative flood in this area with Marathon, wouldn't it be appropriate to have a cooperative flood by your developing the lower San Andres and then at a later time entering into a cooperative flood with us for flooding both the upper and lower San Andres?

A The problem is that aside from three well locations we have seven hundred thirty acres on the south end of the Bridges State lease which is hardly economical to operate. It

is at the end of its primary depletion and the logical thing to do is try to improve the recovery, increase the reserves and increase the production by stimulating that production with some sort of secondary recovery effort. We started in 1958 to trying out a waterflood in this field and it has just expanded up to the south line. We are trying to take in the rest of it now.

Q Just a couple of more questions, Mr. Kelly, and I will be through. Down south of Marathon's lease in Section 36 there are Getty wells shown on the map. Are those wells producing, presently producing from the upper San Andres formation?

A Let me say that I have, at one time or another, checked, looked at the completion information on wells in Section 36 in general and have the opinion that both the upper and lower San Andres is open in a good many of those wells.

Q Are these top allowable wells at the present time?

A I think it would be fair to say that they generally are.

Q Would they be creating a pressure draw down that would set up a gradient from your injection wells across Marathon's acreage down to the Getty acreage?

A I think that possibility exists. That could happen, of course, I don't really know what the pressure in the upper zone is down there. I do know that in general that both the upper and lower pay improved quite a lot down in that area and

I suppose it is conceivable that even with Getty continuing to produce down there it might possibly be that the pressure differential is still -- the gradient is still from south to north. I just don't know. I just don't know.

Q Have you made a recent study of the Getty production in Section 36?

A Just in a general way. I have noted they have got good wells and they have got good looking pay sections on the logs.

Q Do you know what their bottom hole pressures are?

A I don't remember now but I have seen it. I have seen all of the pressures that are reported in the New Mexico Engineering Committee Report and there may be one in there, I don't recall specifically whether there was one on Getty or not. If there is one in there, I have seen it, but I couldn't tell you what it is.

Q On the Well No. 13 that you propose to convert to an injection well, how is that well presently completed at this time?

A It is completed through perforations in the Blinebry pay.

Q What is your current level of production in the Blinebry?

A The order of five hundred barrels per month. I think that it should continue to produce for a minimum of another

three years, perhaps as much as five, before reaching the economic limit and it has got to be down close to the economic limit before I can justify converting it.

Q Do you plan to convert it at this time?

A No, Sir. I want authority to convert No. 13 at such time as the wellbore becomes available for injection into the upper San Andres and I will state that it is my current estimate that the remaining reserves will be produced from that well somewhere between three and five years time from now.

Q You want authority now for something that you may not do for three or five years, is that correct?

A Yes, Sir.

MR. MORRIS: I have no further questions.

MR. PORTER: Mr. Kellahin?

CROSS-EXAMINATION

BY MR. KELLAHIN:

Q In connection with the testimony about water and the encroachment on the Marathon lease, as I understand, it is your position that there will be no encroachment because of the pressure, is that correct?

A Well, I suppose it could boil down to that. That is not just what I said or intended to say.

Q What did you intend to say?

A Well, what I said was that as long as Marathon is not withdrawing fluids from the upper San Andres interval beneath

their lesse I think the likelihood is very slight that a significant amount of water will invade their lease during the life of Mobil's flood. I think that is the substance of what I have tried to say several times.

Q Well, the fact that they are not withdrawing then would create a pressure?

A I think in a way it would. In all probability there would still be a pressure gradient from the injection well to the Marathon lease and still be some movement, but I think it would be a slow thing.

Q But if Mobil were to shut in the tier of wells in the South Half of Section 26 there would be no water down in their direction, would there? -- Encroachment of water down in that direction, would there?

A That is to the same extent, yes, Sir. That is basically true.

Q That oil then would stay there until the offsetting operators were prepared and ready to join you in a cooperative flood?

A I suppose if we would pool enough not to produce, it would stay there.

Q And it would be available for a later flood?

A It could be. It all depends upon, you know, how things developed. If our flood comes along and we get through with it and plug the wells out and still are faced with some

possible secondary reserves laying down there, we will just have to re-evaluate the economics of it at the time.

Q Now, in connection with the Continental lease, it is your proposal to convert the No. 29 well to injection?

A Yes, Sir.

Q What is the present state of that well -- is it completed in both zones?

A The well is at this time completed to a sufficient depth, I believe, to expose both zones. I don't know whether 29 has any lower zone in it or not.

Q In any event, you will plug it back?

A I don't know whether there is any porosity in it or not and --

Q You will plug it back?

A Yes, Sir, to the upper San Andres.

Q And is the same true with your 15 well?

A Yes, Sir.

Q Now, you propose to drill a well, I think, directly south of your No. 26 well.

A Yes, Sir.

Q And directly to the north of Continental No. 6 well.

A Yes, Sir.

Q Seven hundred sixty feet.

A I expect the well to be -- if the application is granted -- approximately seven hundred sixty feet from

Continental's No. 6 well and five hundred fifty feet from Mobil's No. 26 well.

Q Where is the No. 26 well producing from?

A I believe it is producing just from the upper San Andres now, although I say producing now, it is really not really producing anything right now it is shut in. It went to a hundred percent water a couple or three weeks before the June 10th hearing. I don't really know where the water is coming from. I thought at that time it must be coming from the bottom of the hole, but since then I have decided I really don't have an opinion as to where it is coming from.

Q Is the well open?

A It is not intended to be. It was drilled into the lower San Andres and some water production was picked up there and it was plugged back with cement.

Q You say it was not intended to be. What I want to know is it or do you know?

A I just don't know. The cement was placed in the bottom of the hole and I don't know whether --

Q Do you know whether it was effective or not?

A That is right. I don't know.

Q I think the No. 12 well would be the well we are talking about there, would it not -- is that in the San Andres, that well, that cluster of three wells there?

A The No. 12 is the San Andres well. Yes, Sir.

Q And how is it completed?

A It is an open hole completion.

Q In both zones?

A Yes, Sir.

Q Now, if the No. 26 and the No. 12 watered out, what would you do with those wells at that stage?

A At such time as producing wells 26 and 12 were watered out from the waterflood --

Q Well, whatever would cause it --

A Well, I can't enforce any decision I might make now on who is concerned with this at the time, but my opinion is that the wells would probably be plugged.

Q If the wells were not plugged or if water encoached in any volume in those wells, would it not be possible it would get into the lower San Andres zone through those two wells?

A Through which two wells?

Q 12 and 26 -- if you have an effective cement job on the 26 I suppose it would not.

A That all depends on whether it would shut the well in or continue to produce it. I think it would continue to produce it. No. I don't believe water would get into the lower San Andres.

Q If you shut in for any cause it would not?

A I think it is logical to conclude that due to whatever pressure differential could be developed in the wellbore between

the upper San Andres and the lower San Andres, if the well were shut-in, yes, fluids would exit from it, would enter the well from the higher pressure zone and leave through the lower pressure zone and if it happened that the differentials were in that direction, yes, I think that would happen.

Q If you had a waterflood in one zone and none in the other the pressure would build up in the waterflood zone, would it not, logically?

A Yes. I don't really know how high it would build up in the producing well. I know that we have one or two wells out there in the flood proper and these are wells that are tied in to injection wells where the injection wells and producing wells are tied together with this high permeability zone that I have talked about where the wells will stand just about full when they are pooled, but, in general, our wells don't run over out there in the waterflood when they are pooled, so using that information as a basis for estimating bottom hole pressure in the vicinity of a producing well, I could probably come up with some number that would represent an order of magnitude that we can usually encounter.

Q You don't have a bottom hole pressure on any of the producing wells up in the upper part where the flood has been in effect?

A No, Sir. Those are all pumping wells, of course, and we don't take pressures on them.

Q Do you have any estimate of the bottom hole pressure of the injection wells?

A Yes, Sir. I could generate one. At the rock face I think it ranges up to about thirty five to thirty eight hundred pounds, something like that. I'd have to sit down and calculate it to give you a real good number, but I think it is that order of magnitude.

Q That is approximately?

A Yes.

Q In connection with your Exhibit No. 4, you defined the red area there in which, as I understand your testimony, you said there was only a one way push from the injection proposal, I take it.

A I think what I said was that the red area is generally subject to a one way push.

Q Actually that would only apply to the South Half of Section 26, would it not?

A It would apply, as I went on to clarify in Exhibit, I believe it is, 7, the one way push by itself applies only to the red area on Exhibit 7 and there is a three way push that influences the blue area on Exhibit 7, both of which are found in the red area on Exhibit 4.

Q In other words, you have more than a one way push in Exhibit 4 in the red area?

A Yes, Sir. As I attempted to illustrate with Exhibit 7

and companion exhibits, there are two kinds of push that will be affected in that area; a three way push on the blue areas and a one way push on the red areas and no push at all on the green areas.

Q Now, I believe that you indicated that in connection with that exhibit that if you had cooperation with it to the south you'd have a closed flood pattern. Isn't that what you said?

A Which exhibit is that, Sir?

Q Well, if you had cooperation from the south, would that give you a closed flood pattern?

A Yes, Sir. To the extent that we have cooperation it would close it up. It would. If we could cooperate all the way around we could get enclosed pattern reserves off the entire red areas on Exhibit 4.

Q And leave Continental Oil with an open pattern and no cooperation from the south, is that right -- that would be exactly the same situation you are in now.

A You'll have to clarify your question for me.

Q If Continental cooperated with you on a line flood, then they would be in the same position you are in now insofar as their operations to the south are concerned?

A I have formed some opinions about Continental's water-flood reserves.

Q I am not talking about reserves. I am talking about

a pattern.

A In order to answer your question it is necessary for me to tell you this and I don't believe the situations are comparable at all. No, Sir.

Q You don't think it is the same thing?

A No, Sir. I don't think it is.

Q They'd have no backup flood to the south.

A Well, to that extent, yes. That is true. From that standpoint, if Continental did not have cooperation to the south of the State H-35 lease, from that standpoint the situations would be similiar, but from the standpoint of what we have here, the recovery, the oil that we are in a position to lose as a result of carrying on our flood under the existing order, is quite a lot different from what Continental --

Q In other words, you say you will lose more oil?

A I will say that it is my opinion that Continental will not suffer any loss in recoverable reserves if they were to cooperate with Mobil.

Q Providing they recover the reserves.

A They will recover part of them now, that is as the wells respond, and the rest of them whenever they engage in a cooperative flood with other people in other directions to the south, east and west. I don't think Continental will lose any recoverable reserves.

Q Why can't you do the same thing with Continental you

are expecting Continental to do?

A Well, Continental is faced with a different problem than we are.

Q What?

A Continental has only one -- the distance of only the distance between two wells; that is, for example, the distance between Well No. 6 and Well No. 4 it has to flood the oil. Mobil, in recovering the oil in the one way flood, has to push it across in excess of a half a mile in places.

Q Just using the illustration you just gave, doesn't Mobil have the identical situation with the No. 35 injection well and 25 and 26 as a producer -- it goes the same distance, doesn't it?

A I am not sure I follow your question.

Q You just testified, did you not, that Continental only had to be concerned with the distance between Well No. 6 and Well No. 4?

A That is right. Between 6 and 4 and between 6 and 3 and between 6 and 5, yes.

Q And don't you have the same situation with your Well No. 35 to the north, the distance between 35 and 26?

A Yes, but there is a further distance to the east there over to 25 and, of course, we'd have to keep injecting into 35 to get the oil across to No. 25, under the configuration that I think you are talking about, and in such event we'd push all the

oil, off of our lease to the south on beyond 26. Of course it is possible that we'd sit there and produce one hundred fifty or two hundred barrels of water a day out of No. 26 for five or six or seven years or without getting any oil to stop that, but I kind of doubt if we'd produce an oil free well for very long.

Q Well, Mr. Kelly, along that line, wouldn't the same thing happen to Continental in their Well No. 6 -- you don't say that water won't encroach on Continental's lease, do you?

A No, Sir.

Q It will encroach their Well No. 6?

A I think it will.

Q How do they protect their No. 4, then?

A From what standpoint?

Q Do they produce a hundred fifty barrels of water from the No. 6 well -- won't the same illustration apply?

A You mean after the water encroaches on No. 6?

Q Yes, Sir?

A Well, of course, we have switched horses back and forth. We are not talking about cooperative flooding any longer.

Q No. We are not. We are talking about now you have made certain comparisons and I am trying to point out, at least for the Commission's benefit -- I think they are getting it -- I hope -- that the comparison you made applies equally to your lease as to Continental's. That is what I am trying to get at.

In the specific instance of the so called -- what I will call the line injection well between No. 26 and No. 6, that Mobil is recommending to be authorized for drilling, it will be two hundred feet closer to Well No. 26, Mobil's only producing well in that pattern, than it will be to No. 6, Continental's producing well that will be influenced by that injector. There is no reason at all for Mobil to continue injecting into that well after the waterflood reserves have been recovered by No. 26. Now, because the well is two hundred feet closer to our producing well in that pattern, the only one that we have to allow on to get the oil is Continental's No. 6 producing well.

A I think there is very little likelihood that anything such as what I think you are talking about would have occurred, that the water bank would advance beyond Well No. 6. I think that it will. I think that the level of injection it will have to maintain in that well to keep from watering out our own producing well which is two hundred feet closer to it than your well is such that there would never be any real problem encountered in Continental's No. 6 well.

Q The only problem they will encounter is if you water it out.

A I think that over a period of time the well will water out and produce five thousand barrels of waterflood oil. Yes, Sir. That is it would water out from the north and because I think that will take place over a period of about fifteen years,

because that is how long it will take us to flood out that pattern that No. 26 produces from, so I think at the end of that time Continental will just about have recovered its five thousands barrels of waterflood oil plus whatever else enters the well from a primary mechanism and the water bank will be just about at the vicinity of the No. 6 well. There will be a higher oil saturation south of it as a result of the injection and those reserves will be laying there for Continental to recover on any cooperative flood that they might engage in sometime in the future because the injection will cease in the Mobil's wells when our producing wells are gone.

Q Well, what injection rates will you have on that well offsetting Continental No. 6?

A I haven't designed that injection rate either, but speaking broadly, I'd say that it ought to be about -- let's see -- it is five hundred sixty feet from the producing well as compared with thirteen hundred twenty feet for the other injection well -- it would be somewhat less than half of the injection rate of the other injection wells in that pattern.

Q What is the other injection wells?

A Well, I don't really know what they are going to be. I haven't calculated them and my opinion is that the physical factors will control it finally. I believe probably, after a period of a few months, it will be down to the vicinity of five hundred barrels per day or perhaps less in those wells.

If that is the case, we are looking at injection rates into the well that we want to drill north of Continental's lease -- somewhere in the order of two hundred barrels a day.

Q Which wells are you talking about now, two hundred barrels a day?

A The well that we want to drill north of Continental's lease.

Q That one you are talking about, four hundred barrels in the other wells --

A I hope up to five hundred.

Q Is that the figure you had in mind when you said Continental wouldn't be watered out for fifteen years?

A Well, I know that it will take -- if everything goes according to my plan -- about fifteen years for us to flood out Well No. 26, the pattern of No. 26, just as on the average, that is the time we will take to complete the flood and I know that we are not going to inject into the line injector a sufficient volume to water out our No. 26 well which is two hundred feet closer to the injection well than Continental's well and so, yes, I think that that is where the fifteen years comes from. Whatever the design injection rate is, finally controls what the production well does. If the thing is watering out with fifty barrels a day, we will have to cut it back to twenty five.

Q As of right now, you don't know, isn't that the

truth?

A That is right, but I can speak relative.

Q Now, you testified as to the waterflood oil to be recovered by Continental.

MR. PORTER: Mr. Kellahin, we will take a ten minute break.

(Whereupon there was a short recess.)

MR. PORTER: The hearing will come to order, please.

Q Mr. Kelly, ~~before the recess~~ I started to ask you about this waterflood oil that you say the No. 6 well would recover. About five thousand barrels did I understand you to say?

A Yes, Sir.

Q And you just testified that you don't think that well will be watered out for approximately fifteen years?

A Well, in that range. I expect that the No. 6 well of Continental's will be watered out contemporary with the watering out of No. 26 and I haven't any better estimate right now than the estimated flood life which is about fifteen years. It could be less than that.

Q Well, let's assume for a moment it is fifteen years and the well would recover five thousand barrels of waterflood oil. That comes out to about three hundred thirty three barrels a year, doesn't it?

A I will accept your arithmetic.

Q Or thirty barrels per month. Have you considered the economic limits of production?

A Yes, Sir. The economic limits that I have determined from Mobil's wells is about seventy barrels per month on primary and about one hundred fifty barrels per month after a good deal of water comes in on them.

Q Well, Continental's No. 6 well would never achieve that would it?

A It would never achieve what?

Q One hundred fifty barrels a month?

A It is conceivable that it would not. Of course, in that event there would be no harm caused to it at all.

Q If it couldn't produce, it is not condemned, is that what you are saying?

A If the well plays out and our injection into the well offsetting Continental has no influence on its productivity, why, it follows that the likelihood of any harm having been caused is very slim.

Q But you do say it has five thousand barrels of water-flood oil. This is your best estimate?

A Yes, Sir.

Q It has five thousand barrels, roughly, of primary oil?

A Yes. About the same.

Q Now, will that be recovered -- as I understood your testimony, you said five thousand barrels after injection was

started in your offsetting well.

A Yes, Sir.

Q So that primarily --

A That is five thousand barrels will be pushed to it. Of course, it depends on the pressure differentials affecting the well. If the oil comes to the well as so we have discussed that it might do so, why, in that case I would expect the No. 6 well to go ahead and produce its five thousand barrels of remaining primary, if that is a good figure, in addition to whatever is pushed to it.

Q Now, getting back to your Exhibit No. 4, in the red area I believe you testified that there was a million six hundred fifty six barrels of recoverable oil underlying that area.

A Underlying the red area. Yes, Sir.

Q You didn't mean to infer that that oil would not be recovered unless this application is approved, did you?

A I went on to estimate the amount of that oil that I think will not be recovered.

Q Well, going on over to your next exhibit -- No. 6, I believe it is -- did you testify that in the red area you recovered fifty percent?

A Yes, Sir.

Q And that is all. In other words, your flooding in the North Half of Section 25 is just not an effective flood

then, is it?

A In the North Half of Section 25.

Q That is it.

A Very slim, yes.

Q And then you say that none of the oil underlying the light green area would be recovered at all?

A Under this flood configuration Mobil wouldn't recover any of the oil underneath the green area. I think that inasmuch as I have calculated there is some nine hundred nineteen thousand barrels of recoverable oil under the red and the blue areas and the green area that won't be recovered by Mobil. I think that a good portion of that would go ahead and be pushed across the line. There would be, at the end of the flood -- I envision the green area would be highly saturated with waterflood oil and such as to accommodate nine hundred nineteen thousand barrels and however much space is required across the lease lines to accommodate oil that is what would be required. I think, without having calculated it, I'd estimate in all probability that a good amount of that nine hundred nineteen thousand barrels would probably be pushed across the lease line.

Q To whose lease?

A To the adjacent leases to the south. That would take in, in part, Texaco on the Shell Q lease, Marathon on the State McCallister lease, Continental on the State H-35 lease and Phillips on the Mobil lease.

Q Now, you say the oil will be pushed across there if you don't put these wells on injection. Is that your testimony?

A Yes, Sir. If we don't inject into the wells that we are asking for permission to inject into today and carry on our flood under the orders that we have at the present time, yes.

Q Yet you testified that if the 13 well, for example, and the 14 well offsetting Marathon to the north were put on injection, the water would not encroach but the oil will. Is this your testimony?

A I don't believe I said exactly what you say. I will try to restate what I said with respect to injection into No. 13 and 14 and 25.

Q Please do.

A So long as Marathon is not withdrawing fluids from the upper San Andres on the State McCallister lease I believe there will be very little water encroach on the Marathon lease as a result of Mobil's waterflood.

Q O. K. So long as Marathon is not withdrawing from the upper San Andres lease.

A Yes, Sir.

Q Your oil would not encroach either, would it?

A Oh, yes it would encroach to the extent that the gas saturation is substantially eliminated. Of course the oil goes in front of the water. I hope that is what happens.

That is what usually happens. That is the aim of the whole thing. The oil goes in front and resaturates the gas saturation that is ahead of the oil bank and, of course, wherever the water bank stops immediately in front of it is a very richly saturated interval and I have tried not to say where it will stop. I don't know where it will stop, but in my opinion the water will not encroach significantly onto the Marathon tract under the assumptions that I made.

Q In connection with your Exhibit No. 10 -- I don't think we need to refer to it -- you recall what it is -- you showed a high permeability area and did I understand you correctly to say that this area accounts for the early water production in offsetting wells?

A It is that interval which I understand I interpret as being responsible for the early breakthrough of water production on the producing wells -- yes, Sir. That interval and one comparable to it farther south.

Q Have you ever run an injectivity profile on any of your wells?

A Yes, Sir.

Q Did it reflect this?

A Yes. In and around the old pilot we ran a good many injection profiles and found ample quantities of water going into the interval that we could identify as being the highly porous outer permeable zone.

Q All of the oil is not produced solely from this highly permeable zone, is it?

A No, Sir. It is not.

Q Then you are actually bypassing the oil in the formation?

A Well, yes and no. It depends on when you are talking -- what stage you are talking about. The water continues to enter the lower permeability rock as it continues to enter the high permeability rock, but we have observed that by maintaining the injection the way we have controlled it that we can get enough water into the low permeability rock to push oil out of it into the producing wells to justify continuing to operate the flood. In the case of No. 10, for example, this ranges up to about seventy barrels of oil a day at the present time. No. 10 was substantially gone. It was gone before the flood was expanded in 1967 and it has come on back and we make a lot of water out of it now. I think it is coming through that streak.

Q The water is coming through the permeability streak?

A Yes, Sir, but the oil is coming too.

Q Have you made any effort to selectively inject in any of these wells?

A I don't know how to answer that question properly. We are dealing with open hole completions. Most of them are shot. It is a pretty difficult thing. I don't know of any mechanical way that you could control injection. There is

always, you know -- there are various additives that you can use that are intended to improve profiles.

Q Now, were any of these wells fraced?

A A good many of them have been fraced.

Q Could that have caused vertical fractures into the lower zone?

A I beg your pardon?

Q Could the frac job cause vertical fractures into the lower zone?

A If the lower zone was opened to the frac treatment, I suppose that it would, yes, Sir.

Q What I am getting at is, I am talking about vertical fractures connecting the upper and lower zones. Is there any possibility of that?

A Well, I have said before anything is possible, but I think that would be extremely remote to frac down two hundred feet. I think that is a very remote possibility. Besides, treatments that we use out there, when it is considered there are two hundred or four hundred feet of open hole interval open in the well, I think it is inconceivable that a frac treatment would go down another two hundred feet. There is so much rock opening in the well to suck up the fluid.

Q How many analyses have you made in relation to the fractures?

A I don't understand.

Q How many analyses have you made of the length of the fractures in the formation?

A I haven't made any analyses of the length of fractures in formations.

Q Mr. Kelly, in your direct testimony you testified that Mobil had invested a million nine hundred thousand dollars in a waterflood project. You can recover a considerable amount in that, can't you?

A We have recovered a good bit of waterflood oil, yes. I don't know right now whether the project has paid out or not. I do know the six hundred thousand dollars we have got tied up in the south flood hasn't paid out and it won't if we don't get this acreage under flood.

Q Which well?

A In this expansion that we ask for permission to go to, in the June 10th hearing.

Q Are you telling me you spent six hundred thousand dollars on this already?

A Yes, Sir.

Q When did you spend that?

A During the first half of 1970.

Q What did you do with it?

A We built a ten thousand barrel a day injection station. We put in injection lines. We converted wells.

Q Did you get approval of this Commission to convert

these?

A We filed the necessary reports to convert them. Yes, Sir. In that sense, we didn't get permission to inject into them. We obtained permission to convert the wells into injection.

Q And you have not injected them?

A We have injected into all of the wells that the Commission has given us permission to inject into.

Q But that does not include the wells offsetting Marathon and Continental, does it?

A That is correct. We don't have permission to inject into those.

Q Now, you made a suggestion that Continental spend its own money and protect itself against your flood by the installation of liners. What would be the purpose of the liners?

A The purpose that I envision of setting line in one of these open hole completions of Continental's would be to shut off the water that is entering the well from the upper San Andres and at such time as that water production becomes prohibited.

Q And that is water that you have put into it?

A Yes, Sir.

Q Mr. Kelly, one other question here. In connection with your Exhibit 50, you have the productive history of the Bridges State well No. 57.

A Yes.

Q In the exhibit it states that it was found that the reported production from Well No. 57 in 1965 and in 1966 was substantially greater than the well test capacity in that actual production for the No. 57 had declined to the economic limit late in 1966. A re-allocation of battery production based on well tests through the period and so forth was made. To what wells did you then attribute this production?

A I don't know. I had somebody else do that for me.

Q Do you know whether that excess production reflected on Exhibit 5D is reflected in the other exhibits which are a part of your Exhibit 5?

A I am not sure I follow your question.

Q Well, you made a --

A You are asking if the excess production that was attributed to No. 57 was taken from the other wells?

Q No.

A What is your question?

Q What I mean is when you re-allocated it, is this re-allocation reflected in any other Exhibits before this Commission?

A No, Sir. In that exhibit, that plot of production for Well No. 57 represents what was reported to the Commission and it is my opinion that it was in error by the amount that I have indicated and that is an estimate, of course.

Q Is it possible that that production could have been

produced from wells shown on Exhibit 5A, B, and C?

A I don't remember which of those wells produced into which batteries and I suppose that would be a possibility. The wells are generally in the same geographical area, although I seem to remember that these wells were producing into two different batteries around the old pilot and I just don't remember whether 57 was in the same battery with the other three wells or not.

Q Well, then, to the extent that Exhibit 5D is in error, your other exhibits, 5A, B and C could be in error also?

A I don't believe I accept that. I don't.

Q You don't know where the oil comes from but it didn't come from 5D?

A It came from some place on the lease. You see, in this instance we were dealing with allocated battery production. Now, I am not quite sure right now just how Mobil allocates its production between the wells on lease in making the production reports. I know it is done on a computer and it may well be done on a lease basis in which event the production could have come from anywhere. Of course, it is supposed to be -- the well tests are supposed to be input to the computer program as they come in, but they are not always input and a high test or low test will be carried forward too long on a well and as a result its production will be reported too high or too low.

Q Mr. Kelly, I will accept your explanation how these

things occur. What I am trying to arrive at is the information you have presented to this Commission is not accurate to the extent that the production from the 5D is wrong, is that correct?

A I think the information that I presented to the Commission is correct in that I have reported to them the best testament that we can generate of the production from Well No. 57.

Q Well, could any of that production have come from your Well No. 10?

A It is possible.

Q And that is the one you said showed 40% efficiency?

A About 43.

Q So it could have been a 50 or 60% efficiency?

A Oh, no, Sir. I don't think it would even approach it.

Of course, the average for the four wells was 42%. There was such close agreement between the daily generated from the four wells I was pretty well ready to accept that somewhere around 42 or 43 or 40 or 45% is correct and the reserve calculations that I made didn't utilize the 42% recovery. I used 50% recovery affording a greater reserve to Mobil than the pilot performance actually indicated which, I think, makes my figures tend to be on the conservative side.

MR. KELLAHIN: That is all. Thank you, Mr. Kelly.

MR. PORTER: Any further questions of Mr. Kelly?

You may be excused.

This concludes the testimony of the applicant?

MR. SPERLING: It does.

MR. PORTER: Now, I believe that we have an indication that we have testimony from both Continental and Marathon.

MR. LOPEZ: At this time, Mr. Porter, I believe Marathon is going to precede Continental in presenting their evidence, so if you are willing, we will just go ahead.

MR. PORTER: It is absolutely all right. It doesn't make any difference so far as we are concerned.

MR. LOPEZ: At this time I'd like to call Mr. Zeman.

PAUL ZEMAN

a witness, being duly sworn according to law, upon his oath testified as follows:

MR. PORTER: Let the record show Mr. Zeman has previously been sworn.'

MR. LOPEZ: Then I assume his records are acceptable to the Commission -- his qualifications?

MR. PORTER: Well, he was sworn earlier this morning.

DIRECT EXAMINATION

BY MR. LOPEZ:

Q Mr. Zeman, would you please state your full name?

A Paul Robert Zeman.

Q What is your occupation?

A I am District Reservoir Engineer Supervisor for

Marathon Oil Company in Midland, Texas.

Q You are familiar with the application of Mobil in Case No. 4367 and 4368?

A I am.

Q You are also familiar with the Vacuum Field in Lea County, New Mexico?

A I am.

MR. PORTER: Did you testify in a previous case?

THE WITNESS: Yes, I have, Sir.

MR. PORTER: Alright.

MR. LOPEZ: Are his qualifications acceptable?

MR. PORTER: Yes.

Q Mr. Zeman, have you prepared or had prepared under your supervision some exhibits in connection with these cases?

A I have.

Q Referring to that exhibit as Marathon Exhibit No. 1, would you please refer to it and explain to the Commission what the exhibit represents?

A Exhibit No. 1 is a portion of the Vacuum Field in Lea County, New Mexico. It covers the area of the field which is pertinent to Mobil's request for expansion of their Bridges State Waterflood. Mobil's Bridges State lease is shown bordered in green on the map. Marathon's acreage in the area is shown in yellow. Mobil's present injection wells are shown in blue as the other operators' wells. There is a few in the West

Vacuum Unit and there are some cooperative Amarada wells and Texaco has a well. This map is as of June of this year, 1970. Mobil has requested an expansion of their waterflood to include all of the southern portion of their Bridges State lease and have requested the conversion of thirteen wells to injection. The wells proposed for conversions are shown in red circles. Mobil also proposed to drill two injection wells. They have since eliminated that to one and done away with one. These wells were originally located in E25, 17, 34 and in 26, 17, 34 and are shown as red triangles on the map.

Referring to Section 25, Township 17 South, Range 34 East, Marathon is the operator of the State of New Mexico McCallister lease. Mobil's Bridges State lease offsets our acreage to the north and west. Three of Mobil's proposed injection wells directly or diagonally offset our acreage. These wells are the Bridges State No. 25, proposed conversion 660 feet west of our acreage. In 12, to the north Mobil proposed originally to drill a well three hundred thirty feet from the lease line -- our lease line. They have since scuttled that well and propose to, at some future date, convert No. 13, which is a Blinbry producer, to an injection well. Mobil's Bridges State No. 14 is a proposed conversion, is a northeast diagonal offset to our acreage. Actual Grayburg wells in here are shown in little circles around it and all the wells are shown on the map and the rest of them are just plain dots.

Marathon presently has four producing Grayburg wells on the State of New Mexico McCallister lease. Three of our wells are capable of making top allowable and one is a marginal well but still making a considerable amount of oil. These wells are wells 1, 2, 3, and 4. Marathon's wells on the McCallister lease are no where near stripper category and the acreage is not ready for waterflood.

Marathon is of the opinion that injection of water into the three offset wells offsetting our acreage may cause premature water breakthrough in our wells thereby reducing our oil productivity of the wells and the ultimate recovery from our lease.

This assumption was made on the basis of going down and picking both zones of porosity. We assumed that through this workover program that we have started and completed on this lease -- I will go into that in some detail -- that we will be able to go up into the upper section later, much later and get some oil from there.

That takes care of Exhibit No. 1.

Q Referring now -- I refer to Exhibit No. 2 which is in booklet form.

A Yes.

Q And I would ask that you commence explaining what Exhibit 2 is.

A I have here in this booklet data relating to lease

well production, production tests, well completion information and some reserve data for our McCallister lease in the Vacuum San Andres Field.

Turning to Page 1, we have four producing wells there. Our wells or lease commenced production in July 16, 1938. As of August the 1st of this year we have produced one million eight hundred forty eight thousand four hundred sixty eight barrels of oil; a little over eighteen thousand barrels of water and one million eight hundred eighty six thousand MCF of gas, approximately.

During July, 1970, our wells have produced eight thousand four hundred fifty eight barrels; less than a thousand barrels of water and a little over ten thousand MCF of gas.

Turning to Page 2, this is a lease plot of the annual oil production and the annual water production for the four wells. I have taken it from 1959, which is the year we started our deepening program in running liners on the first well. It also coincides about the time that Mobil's Bridges State started to be flooded. As you can see, in 1959, our oil, annual oil production from the lease was 46,000 barrels a year. In 1969, the oil has increased to 87,000 barrels per year and the dashed line there is anticipated 1970 production of 95,000 per year based on the first six months' production of the lease.

Our water production has been nominal since 1967 and has been real low. The maximum is around ten thousand barrels

per year.

Now, continuing on over -- before I get into the individual wells and what we have done I'd like to refer to Exhibit 3, which is a cross section, AA Prime. I will refer back to Exhibit 2 later when we go through our workover program. We can use Exhibit AA as a kind of a visual aid.

Exhibit No. 3 is a cross section AA using sonic or acoustic logs through the San Andres section of four of our deeper producers in the lease. Each of the wells that we use here is a twin to a Grayburg San Andres producer. If you look at the map in the corner here it starts with Well No. 10, McCallister State No. 10, which is a twin to the Grayburg Well No. 1. It goes over, counter clockwise, to Well No. 8 which is a twin to 3; goes north to Well No. 6 which is a well to 4 and it goes to 9 which is a twin to 2.

These deeper wells are dual completions in the Glorietta and Blinbry.

Referring to the cross section, I have marked the top of the San Andres. It comes in about -320 to 350. I have marked the top of the Lovington Sand and the base of the Lovington Sand so in effect this upper section of the San Andres is the upper San Andres section.

I have marked the base of the Lovington Sand. I have taken the estimated oil water contact of -750, based on our work in this lease of deepening the wells. As you know, down

between the Lovington Sand and the oil water contact we have come up with a body of porosity. For purposes of identification, I have called it "top of the lower massive porosity". It has got quite a bit of continuity and I think it is pretty obvious to see.

I'd like to now go back and we will discuss our workover program for Well No. 1. This Well No. 1 is the first log on your left hand side and I have superimposed on these deep wells the original completions and the deepening and the liners that we ran and I also have a porosity scale and the coloring in red is what I estimate to be net pay.

Referring to Page 3 in the booklet on Exhibit 2, our No. 1 well, which is the first well on the cross section, or the twin of 10, was completed in July, 1938 and here I want to make a comment that I have accumulative production to August 1st and after I had this thing printed up I checked and some of our computer sheets have a few bugs in it, so this number is not quite right, but for purposes of this hearing the magnitude is correct.

Cumulative production for August 1st for No. 1 well was over four hundred twenty thousand barrels. It never had any water and gas is about the same, thousand one ratio.

Listed below I have a production test for this well. On August the 3rd, 1970, the well flowed through a 18/64th inch choke, one hundred three barrels of oil and no water. September

11th, 1970, the well flowed 85.5 barrels of oil in twenty one hours at a reduced choke of 15/64th.

September the 12th, reduced the choke lower to 13/64ths inch and the well flowed eighty four barrels of oil per day and no water.

Turning to Page 4, this well was originally drilled to a total depth of 4,680 and I have that shown on the log and it was open hole from 4,083 to 4,680. There was no treatment from this interval included. Of the lower Grayburg, it flowed fifty one barrels of oil per hour or at the rate of 1,224 barrels of oil per day through a one inch choke.

Other data here, in January, 1941, the well was still flowing forty six barrels through a 19/64th inch choke. In April, 1947, we installed our pumping unit. Before the pump installation the well pumped ten barrels per day. After the pump installation the well pumped forty barrels per day.

In 1959, September, October, 1959, we commenced our first workover. It consisted of drilling the well deeper and running a liner.

Prior to this workover the well was pumping 13.8 barrels of oil per day. The workover procedure stated here cleaned out the open hole from 4,083 to 4,680. Drilled six and one-eighth inch hole to 4,705. We set the four and one-half inch liner from 3,904 to 4,670 and cemented with a hundred

sacks. We drilled out the cement and shoe and cleaned out to 4,705 total depth.

Now, we tried to get the liner all the way to the bottom but couldn't make it so the well was producing from an open interval 4,670 to 4,705. That is shown in green. Everything up above the hole is colored in red. It is net pay. That is the upper section of the San Andres, that is behind pipe.

If you look at the curve on Page 5 you can see in 1959 we have established a pick as a result of this workover in No. 1. Production has been rather uniform from 1960 to 1964 which is just the result of a low normal unit allowable and you can see what is happening as the normal unit allowable is going up. The well still has never made any water.

Referring to Well No. 2 and that is a twin to No. 9, which is the last log on your right --

Q Excuse me, Mr. Zeman. This Well No. 2 is the well that is a good well but not making a top allowable at the present time?

A It is a marginal well but still making a considerable amount of oil. I will touch on that shortly. This well was drilled, commenced production of September 1938 and it has made over four hundred thousand barrels of oil and it has made sixteen thousand barrels of -- over sixteen thousand barrels of water and most of this water as a result of a

recent workover.

We have some production tests here. In July 2nd, 1970, the well pumped thirty four barrels - - a little over thirty four barrels of oil per day and twenty three barrels of water. On September the 9th, 1970, the well pumped about forty barrels of oil and twenty six barrels of water.

We took some pumping fluid levels by sonic measurement September the 4th, 1970. The flood level was seven hundred forty two feet over the pump. On September the 10th, 1970, it was eleven hundred seventy six feet over the pump.

The original completion in the No. 2 well was drilled to 4,700 feet and completed open hole, seven inch casing set at 4,101 and it flowed from both the Grayburg and the San Andres forty five barrels of oil per hour or at the rate of 1,080 barrels of oil per day. There was no treatment. It flowed naturally.

In January, 1941, the well on the test flowed one hundred ninety two barrels of oil per day through an 11/64th inch choke. In January, 1949, we installed our pumping unit. Before the pump was installed we produced about ten barrels of oil per day and after the pump we pumped seventy five barrels of oil per day.

In July, 1968 through August, 1968, we worked this well over the same procedure we did in the No. 1 well. We drilled it deeper, ran a liner.

I want to state here that these liner jobs, they have cost Marathon Oil Company anywhere from \$28,000 to \$42,000 apiece. We have other leases in this field that are open hole and we are going to run liners as warranted. I think next year we have two or three set up.

Going back to this No. 2 well --

MR. PORTER: How much on the No. 2 -- how much oil is that well making at the present time?

THE WITNESS: The latest was it was making about forty barrels a day pumping. We plan, looking at it in the area office, to frac this well. This thing was never fraced and they are thinking about it anyway, to try to improve the production a little bit, but we have cleaned up the whole workover procedure.

The well was making nineteen barrels of oil per day before the workover procedure. We cleaned out the hole to 4700 and we drilled to 4,788; set a four and a half inch liner and we did some perforating and that is all discussed there and the gross perforated interval is from 4,680 to 4,736. We gave a treatment of four thousand acid and it did pump on initial potential as a result of the workover seventy one barrels of oil per day; but four barrels of water, pumping twelve fifty four inch strokes per minute.

Referring to the curve, you can see we were pumping along pretty even and when we worked our well over we got a

kick. We also got a kick in the water and this well is accounting for most of the water on the lease. It has gone down. As I say, the area office is looking at working this over, fracing it, bringing the production up.

Going to the No. 3 well on Page 9, that is a twin to 8. That is the second log over from your left. This well commenced production in around December, 1938 and it has produced about four hundred eighty thousand barrels of oil; very little water -- a little over a thousand -- and I have two production tests shown for this well. On August the 2nd, 1970, the well pumped seventy barrels of oil per day, about 7/10ths water. September 1st, it pumped seventy three barrels of oil per day and about 7/10ths water.

We took our flood, our pumping flood levels by sonic measurement on September 4th. The flood level was 1,998 over the pump. September 10, 1970, we have 2,059 feet over the pump.

This well, I am sure, could produce a little more oil than seventy barrels. We have a good fluid level in it.

The well was originally --- turning to Page 10 -- the well was originally drilled to a TD of 4,690 and completed open hole from 4,081 to 4,690. No treatment. It flowed thirty eight barrels of oil per hour or at the rate of 912 barrels of oil per day.

In March, 1949, we installed a pumping unit. Prior

to pump it was making about ten barrels a day. After the pump installation it was making eighty barrels a day.

This well was drilled deeper and liner run in March and April, 1968. Prior to the production of -- prior to the workover the well pumped twenty one barrels of oil per day. Workover procedure is basically the same as all of them so far discussed. We cleaned out the open hole to 4,690; drilled to 4,786; set a liner to 4,782 and reperforated over a gross interval from 4,663 to 4,763; treated with two hundred gallons of acid -- two thousand gallons of acid -- I am sorry -- and the well pumped seventy one barrels of oil per day plus ten barrels of water per day pumping fourteen forty-four inch strokes per minutes.

Looking at the curve for this well you can see the results of our workover. In this well in 1969, which is the first full year after the workover, the well has gone from about seventeen thousand up to twenty six thousand, approximately -- very little water produced.

No. 4 well, which is the last well on the lease and is a twin to No. 6, which is the third log over on the cross section, commenced production in February, 1939. It has produced over four hundred eighty thousand barrels of oil; very little water. The gas oil ratio has a little over a thousand to one.

Our production tests; in August 23, 1970 the well pumped 76.4 barrels of oil per day, very little water -- .8 barrels per day.

September the 6th, 1970, the well pumped 84.1 barrels of oil per day and 8/10ths barrel water.

Our sonic measurement flood level September 4th, 218 barrels over the pump; September 10th it was the same thing, 218 barrels over the pump.

The original TD on the well was 4,710. It is completed open hole from 4,099 to 4,710. No treatment.

The well flowed thirty five barrels of oil per hour or at the rate of eight hundred forty barrels of oil per day -- no water.

Other data; March, 1949 we installed our pump unit. Before pump, flowed ten barrels a day. After pump, one hundred twenty barrels oil a day.

Again, in 1969, completed in January of this year, this is the last well, we drilled the well deeper, ran a liner. Prior to our workover program the well pumped twenty one barrels a day. Again, the workover procedure was drill the well deeper to 4,780; we perforated at 4,737 to 4,747. The well was treated with two thousand gallons of acid and pumped ninety two barrels of oil per day plus twelve barrels of water per day. That water production has gone down somewhat,

the latest test shows.

Referring to the curve on the well, Page 14, you can see that the production has gone down in 1969 and the only thing I can do is forecast 1970 and we have gone from about thirteen thousand barrels a year to approximately twenty thousand barrels per day.

Q Mr. Zeman, am I to understand that this marked increase in production after your well fell off was due to your re-working the wells in the manner indicated?

A Yes.

Q How much do you estimate that it cost to re-work each one of these wells?

A Well, as I say, in the McCallister lease they run anywhere to twenty eight, twenty nine thousand and we had trouble with one and she went up over forty two, forty five thousand.

What I am showing on the cross section, as you will note, all our present production open interval is shown in green and it is all in the lower massive porosity. We do have porosity in the upper San Andres section. We have this cased off. We are looking, trying to deplete this reservoir in an orderly manner.

Our production is top allowable for all practicable purposes. We can't get any more oil because we don't recog-

nize the upper section and the lower section as two separate reservoirs.

I have just tried to discuss the capacity of our wells and I'd like to now talk a little possibly about some of the reserves.

Q Before you do, isn't it true that had you known that Mobil was going to change its application and just inject into the upper Lovington or had our count been granted you could have focused all of your attention on just the upper?

A That is right.

Turning to Page 15, I originally looked at this, all the pay is shown in red here on each of the wells. Now, in Well No. 6 we have this all the way down to oil water contact -- this includes both zones. We have two hundred seventeen feet of pay above a three percent porosity. Our average porosity was 7.7 percent and here I planimetered all this area and got a weighted average. There are streaks in here that are considerably higher, but this is a weighted average.

In No. 8 we have one hundred fifty seven feet gross, both sections of net pay at 6.3 percent porosity.

McCallister 9 had two hundred twenty one feet at 7.3 percent porosity and the McCallister Penn had one hundred forty nine feet at 5.5 percent porosity.

Now, what I have done here, I have tried to say that each of these well logs represents the forty acres that that

well is located on and I have calculated in place reserves for the total one hundred sixty acres and this came to nine million seven hundred twenty six thousand barrels of in place oil.

Now, this afternoon I had to make some readjustments, trying to break out what we have in this upper zone. Of the two hundred seventeen feet in the No. 6 well, seventy five feet is located in the upper San Andres section. In Well No. 8, fifty five feet is located in the upper San Andres section. In No. 9, sixty five feet is located in the upper section. In No. 10, forty nine feet is located in the upper section.

Now, I left the porosity approximately the same and I just proportioned out the original oil in place on the basis of my net pay and I come up with, totaling it up, that out of the 9.7 in place oil, 3.2 million is located in the upper San Andres reservoir. Now, I realize that both the upper and the lower sections were opened for a considerable time before we ran our liner job and I don't know how much oil is coming from each of these zones when in an open hole section, but if I take this 3.2 million barrels of oil that is located in the upper San Andres section and assume a solution gas drive approximately twenty five percent, I come up with a recovery from this zone of eight hundred thousand barrels approximately.

If I say fifteen percent of it has been recovered due to the open hole section, there is some left, I have a

future primary in this zone of say ten percent of three hundred twenty three barrels. This is pointed out by Mobil's testimony. They say that I can get -- you can get half a barrel for every barrel of primary on the waterflood. If the primary in the upper section is eight hundred thousand barrels, then half of it would be, for secondary, four hundred thousand. Add that to the three hundred twenty three thousand that I estimated remaining primary, we have a total volume of seven hundred thousand barrels. Now --

Q Mr. Zeman, since you indicate that there are seven hundred thousand barrels of oil and primary reserve in the upper San Andres, have you been able to estimate how long it will be before you feel that you will deplete the lower San Andres and then begin to selectively perforate the upper San Andres?

A If we can go back to the curve on Page 2 -- you can't use the decline curve -- this thing is just going up. If I started with ninety five thousand barrels of oil per annually and arbitrarily declined it at fifteen percent, I would produce another five hundred fifty thousand barrels of oil, primary oil, and it would take Marathon between seventeen and nineteen years to produce it from this lower section.

Q And that is without the benefit of any re-working or --

A That is right, and that is assuming that I am starting

to decline right next year. I don't see how that is possible, I mean, I am going to let this thing ride at say the current rate for at least a couple of years. Hopefully we might be able to bring No. 2 up if we work it over.

Q Then am I to conclude that Marathon will not be in a position to begin to deplete its primary reserves in the upper San Andres for at least fifteen years?

A At least.

Q Now, do you have anything else to offer concerning Exhibit No. 2?

A No, that takes care of Exhibit No. 2.

I would like to go to Exhibit No. 4.

Q Referring to Exhibit 4, would you please explain to the Commission what that means.

A This is a cross section, a very short cross section that goes from Mobil's State Bridges No. 58 through their No. 36, going, continuing South through their 13, which I understand now is going to be their proposed injection well in the future, and terminates in our Well No. 6, which is a twin to No. 4. What I have tried to show here is the continuity of the Bets. We have the upper San Andres, we have the top of the Lovington Sand, we have the base of the Lovington Sand and I have tried to correlate here the top of the lower massive porosity. I realize that it deteriorates as you go North from our acreage, but I still think there is porosity there. I

cannot read permeability off of the log.

Let's go to No. 58. I'd like to read stuff on each of these wells. This well was completed in April, 1940. It was drilled to a total depth of forty six hundred feet and seven inch casing was set at 4,250 feet with two hundred twenty sacks. Production was from an open hole interval from 4,250 to 4,600 feet. The well was shot with three hundred eighty quarts of nitro from 4,473 to 4,600 feet and had an initial flowing potential of two hundred eighty eight barrels of oil -- no water. They re-completed in the Glorietta in November, 1963.

Now, if you look at the caliper log you can see part of the hole. The large hole goes to the right.

Going to the second well, 36, this well was originally completed July the 9th, 1959. It was drilled to a total depth of 4,590. Casing was set at 4,220 with two hundred ten sacks and produced open hole from 4,220 to 4,590. Original completion in both these two wells I discussed was just in the upper San Andres. They didn't have any treatment listed and the well flowed three hundred seventy six barrels of oil per day. I am getting my data from scalp tickets.

In 1962, the well was drilled deeper and completed as a Blinbry San Andres dual. According to the scalp ticket I don't think the well produced too long in the San Andres.

The San Andres was perforated from 4,743 to 4,811 over a gross interval, treated twenty five hundred acid, twenty thousand sand frac and pumped six barrels of oil, forty barrels of water. This was in the lower massive porosity.

Well No. 13 is the well they plan to use for an injection well, as I understand it now, sometime in the future. This well was originally completed in October 11, 1938. TD was 4,763. Seven inch casing was set 4,200 feet with two hundred ten sacks and we were producing from an open hole interval 4,200 to 4,763. In this case both the upper San Andres and the lower massive porosity were open in the well.

They treated this well with three hundred twenty quarts of nitro from 4,390 to 4,550 and if you look at those depths on that log and you look at the caliper you can see the enlarged hole. We cannot use these logs for porosity determination because it is a sonic and it is susceptible to cycle skipping and actually is meaningless for determining any porosity zone or permeability zones.

The well was drilled deeper in January, 1963 and completed in the Blinbry formation.

In No. 6, as I have already discussed in our cross section, I contend that if they put water in No. 13 here, the upper section, they are going to be putting water on our lease and as Mr. Paxon will discuss later, this water should

get over there within a year to eighteen months and when we get in a position to, in an orderly manner, to deplete our reservoir by going up our liners and perforating these zones in the upper zones in the upper section, I contend they will be full of water.

Q Mr. Zeman, you may recall Mr. Kallahin's question of Mr. Kelly regarding shooting and if there was not a good possibility that such shooting as indicated on these logs would some how vertically fracture the Lovington Sand whereby the injection of water into the upper San Andres you couldn't assure it would not also fall into the lower San Andres.

A That is right. If they ran the liner, if they ran the casing or a liner to complete their Blinbry, I am sure I don't know how high their cement is in this well and if they got a pretty enlarged hole in the upper section, I don't know if you get a real good cement job around your casing and if you are going to have to perforate 13 in the upper section of the large hole, I don't know if you are going to get out in this formation too far.

Q Referring to exhibit marked No. 5, would you please explain what that stands for.

A Cross section CC Prime goes from Mobil Bridges No. 27 down to their Bridges State 25 which they propose to use as an injection well into their 99 which is a deep test and then he is tying back and terminating in the No. 6 well. Again I

have tried to show the continuity of the Bets in the upper San Andres, the Lovington Sand, correlated all the way across. You can see the massive section at the bottom. I'd like to discuss each of the individual wells.

No. 27, which I presume will be their producer in that proposed five spot, this well was originally completed in the San Andres in 1939. It was drilled to a total depth of 4,727. The case was seven inches, was set at 4,220 with two hundred ten sacks and was completed open hole 4,220 to 4,727. It was shot with two hundred forty quarts of nitro from 4,330 to 4,450 and if you look at the caliper log on that well it looks like they shot right above the San Andres and got the lower Grayburg and again your sonic log is chattering all over the place. You can't analyze any porosity there.

In 1962 they drilled deep to the Blinbry and this was the discovery well in the Vacuum Blinbry Field. They perforated, they dualled with the Blinbry and the San Andres perforations were from 4,743 to 4,811 which was in the lower massive at the time and that well potential, after treatment, was twenty four barrels of oil per day and forty barrels of water.

Going over to the second well, this is their proposed injection 25, I have a log shown here that only on 25, that only goes part way to the total depth that was originally

drilled, 4,750. As I understood it, this well had junk in a hole and that is why I used a twin dual Well 99.

Referring to 25 again, it was completed in February 26, 1939 to a total depth of 4,750. The casing was set at 4,200 feet with two hundred twenty sacks and producing interval was open hole from 4,200 to 4,750.

Now, I don't know when they lost the hole or part of the hole. There was no treatment and the well flowed one hundred forty barrels of oil per day.

In the September 1st, 1970 issue of the Oil Reports Mobil submitted application to drill their Bridges State No. 25 by setting a whipstock and drilling around the junk in the hole to the old TD of 4,750.

Again, if they drilled it down to 4,750 they would have penetrated the lower massive porosity in which we are producing now.

I used the No. 99 well just to try to evaluate the part of the No. 25 well that was junked.

Q Mr. Zeman, is it your opinion that had they not changed their minds and proceeded with the project we thought they were up to this morning, that they would probably have an oil well if they did whipstock and take No. 25 back to 4,750?

A I think they have a good possibility.

I have tried to show the continuity of the upper

Betz and you can kind of correlate the porosity. Now, I have no way of knowing what the permeability is there. This is a Dolomite reservoir and very heterogenous and comes and goes. I presume in our acreage it might be somewhat better in the multiples but if they start putting water in there and you have any kind of permeability streaks, whether it is one in the upper part or one in the middle part or the upper zone -- I don't know how many permeability streaks there are there -- the only thing I'm saying if they put water and as Mr. Paxon will show later on, you do have some premature water breakthrough and we can't benefit at the present time from any increase in allowable -- we have spent considerable amount of money to keep our wells on top production -- we have our wells in such a situation that we can deplete this reservoir in an orderly manner -- I have stated we have anywhere from fifteen to twenty years in the lower section. We are going -- as we go out, we are going to try everything that looks like porosity and I feel before it is all said and done, this reservoir, it will probably be Two Thousand Twenty Five before they abandon it. It is one of the better fields in the State of New Mexico.

Q Do you have anything further to add, Mr. Zeman?

A No, Sir.

Q Mr. Zeman, did Mobil ever contact you or indicate in any fashion that they were changing their approach and only

going to inject in the upper San Andres, before this morning?

A No, Sir. I never had any contact with Mobil on any part of this hearing.

MR. LOPEZ: Mr. Examiner, or if the Commission please, I would like to offer Marathon's exhibits 1 through 6 into evidence. However, I would also indulge the Commission's permission to have Mr. Zeman modify the last page on Exhibit No. 2 to reflect his rapid calculations as to the reserves, the figures that would be self evident regarding the reserves in the upper San Andres.

MR. PORTER: The last page, on Page 15 of Exhibit 2.

MR. LOPEZ: Right. Where the calculations there are made for both the upper and the lower San Andres -- what he has done is right next to the net pay, the first column, made calculations as to the amount of pay in the upper San Andres and then taking one half of the average porosity he has come out with calculations that resemble that of both and the lower San Andres but apply only to the upper San Andres and he has already testified to those and, if you don't mind, I think it would be helpful if they were included in the original exhibit.

MR. PORTER: Are there any objections to the admission of these exhibits with the corrections being made in Exhibit No. 2?

The exhibits will be admitted into evidence.

We had a discussion, as I recall it, now, 1 through 13 with all of the parts of the various ones --

MR. SPERLING: Yes. I recall making a reference to the numerical and alphabetical parts.

MR. PORTER: Alright. Would you like to have these exhibits to make these changes and corrections on our copies of Exhibit 2?

THE WITNESS: Alright. I will make those corrections later this afternoon and return them to you.

MR. LOPEZ: That concludes our case.

MR. PORTER: Mr. Sperling, do you have some questions?

MR. SPERLING: I have some on cross examination.

CROSS-EXAMINATION

BY MR. SPERLING:

Q Mr. Zeman, it is evident from the exhibits that you have introduced here and discussed that you concur in Mobil's opinion that there are two zones of porosity within what is designated as the San Andres formation?

A Oh, yes.

Q And you apparently concur in the conclusion that the two zones of porosity are separated by the Lovington Sand, is that correct?

A That is right.

Q What is the character of the rock other than the

Lovington Sand which separates the two porosity intervals?

A What is the character of the rock?

Q Yes. What is the nature of it -- is it Dolomite?

A Well, there is streaks of probably shaliness in the Dolomite. I have tried to show what I think is the porosity.

Q Do you consider this interval including the Lovington Sand to be impervious?

A I really don't know.

Q Well, are rocks of the character that you have described generally to be impervious -- is Dolomite and shale stringers, sand stringers --

A I think that the Lovington Sand will probably be tight and be a seal.

Q How do you reach the conclusion that with your Marathon wells having been re-completed with liners so that the upper San Andres is isolated from the lower San Andres that injection of water into the upper San Andres is going to affect the upper San Andres in the vicinity of your wells?

A Well, I believe that there is all kinds of production still open hole. We are one of the few people that have liners in the wells. There is all kind of production offsetting this to the South and East that are producing from both zones, still causing a sink and having a pressure gradient across the whole field. I will admit part of the upper might be depleted be-

cause it has been open for a good many years and it will probably be lower pressure than the water you are going to inject and you are going to have a gradient from high to low and you are going to have movement from high to low.

Q Have you made any investigation to substantiate that conclusion?

A I haven't done this. I leave this to our waterflood expert that is going to testify, Mr. Paxon, the next witness.

Q Well, I take it, Mr. Zeman, in your testimony you did not mean to imply that injection of water into the upper San Andres at this time that your wells, as complete as they are, would adversely affect your lower San Andres production, would it?

A No, but --

Q You didn't mean to imply that, did you?

A No, no. I am implying that at some later date when we go up in an orderly manner to deplete this reservoir by testing all these porosity zones or what looks like porosity on a log, that if we get up there, it will be full of water.

Q What do you base that conclusion on, which gets back to the question that I asked before?

A Because we are going to be down there lower zone for at least fifteen to sixteen years and your waterflood will be long gone by then.

Q Well, you don't intend to open the upper San Andres for seventeen or eighteen years?

A Not if we are making top allowable.

Q But you conclude that even if the upper zone is not open during that interval in time, that by the time that you do get around to it, in seventeen or eighteen years, you are going to be flooded out, is that right?

A That is right.

Q What do you base that on?

A If you put this water in, you are going to be -- if you convert this injection, you are going to be putting water in -- we have no control over what you are -- how much water you are going to be putting in there.

Q Do you feel Mobil has a right to recover by secondary methods the upper San Andres production underlying its acreage to the West and North?

A If they can do it without adversely affecting us.

MR. SPERLING: That is all.

MR. PORTER: Anyone else have a question of the witness?

CROSS-EXAMINATION

BY MR. MCADAMS:

Q I was looking at this cross section here of your AA Prime and you show some interval between the bottom of

Lovington Sand and the top of what you call the lower massive porosity. Now, in the log of the McCallister State No. 6 well you show this lower porosity colored in red.

A Yes.

Q And you show other portions of this porosity extending on up to almost the base of the Lovington Sand.

A Yes.

Q Now, move back over to the McCallister State No. 8 just to the left of that cross section.

A Yes.

Q Now, you show these red porosity zones going almost up and touching the base of the Lovington Sand, is that right?

A Yes.

Q Is there communication, vertical communication between those portions?

A Communication between the upper sets here?

Q Where you show the red markings at the base of the Lovington Well No. 8?

A I think we'd have to go up and perforate to get it.

Q I am not talking about that. I am talking about in your opinion is there vertical communication between those two?

A Between the --

Q Between that portion of porosity you show at the base of the Lovington down to the --

A I don't know.

Q O. K., in Well 25 of Mobil's, on cross section CC Prime, at what interval did they shoot that well with nitro?

A In 25?

Q Yes.

A They didn't. They didn't treat that with nitro. They didn't, that is, not as far as the scalp ticket is concerned. They don't have -- this is a gamma ray neutron -- there is no log on there.

Q What is the lowest depth of the Mobil wells that have been shot with nitro -- what is the lowest depth at which that explosion occurred or the hole is located or shown on the caliper log?

A On which well?

Q The ones that you are familiar with?

A Well, the only ones that I am really familiar with are the ones on the cross section.

Q Look at them and tell me which ones.

A Well No. 27 was never shot. It looks like it was shot in the lower Grayburg. Now, going on to cross section BB prime, the bottom section shot in No. 27 -- I am sorry -- 58, rather, was 4,600 feet. Although the original completion in No. 36 showed it to have no treatment, I looked at the caliper log and the sonic skipping there in the caliper log,

it looks like somebody shot it at maybe a later date. I don't know, but the bottom of the hole there is about 4,520, approximately.

Coming over to Well No. 13, the bottom of the hole shot was 4,550. That is about where the top of the Lovington Sand is. You can see the bow.

MR. MCADAMS: That is all.

MR. PORTER: Any further questions of this witness?

CROSS-EXAMINATION

BY MR. KALLAHIN:

Q Mr. Zeman, did I understand you to say that the upper San Andres had been opened in your No. 4 well prior to running the liner or running a liner?

A All our wells were open in the upper.

Q Have you any idea what the present pressures would be in that zone?

A No, Sir. I do not. I think they have taken pressures there and I think it is down to about seven -- I think the pressure was originally a little over sixteen hundred pounds and it is down anywhere from six hundred fifty to seven hundred pounds and some of the flowing wells to the South, some of our flowing wells to the South, this Lovington Sand deteriorates and the whole formation becomes one. This starts deteriorating to the South about a mile and a half South of

our lease. The whole reservoir becomes one.

Q You couldn't give us an estimate, though, of the pressure at your No. 4 well?

A No, Sir. I think our No. 1 well a couple years ago was seven hundred fifteen pounds or fifty pounds and that was from the lower zone.

Q Would you consider the bottom hole pressure at your No. 4 well site to be low enough that it would be affected by a bottom hole injection pressure of approximately thirty eight hundred pounds?

A Oh, yes. Oh, yes.

Q And the fact that an offsetting well to the West was being produced, would that prevent water encroachment to your No. 4 well?

A I'd rather, if you would, leave that to Mr. Paxon. He is our waterflood expert and he will testify after me.

MR. KALLAHIN: Thank you. That is all.

MR. PORTER: Any further questions?

RE-DIRECT EXAMINATION

BY MR. LOPEZ:

Q Referring to Mobil's Exhibit No. 8, I believe -- perhaps it is later on -- the isopach map --

A Yes.

Q (Continuing) -- are the indications on that isopach

map concerning Marathon's acreage correct?

A This is 6. They have eight feet of upper porosity for the No. 6 well and I come up with seventy five. They have thirty five, I believe, for 8 and I have fifty five. 9, they have fifty five and I have sixty five. In No.1 they don't have anything listed. So far as I am concerned I have forty nine and then the fifty line goes through 1, so --

MR. LOPEZ: Fine. No more questions.

RE-CROSS EXAMINATION

BY MR. SPERLING:

Q That prompts one more for me. You testified previously that your cut off porosity for the purposes of your calculations was 3%?

A Yes, Sir.

Q Alright, and do you recall Mr. Kelly's testimony to the effect that his cut off was 5%?

A He stated that. Yes, Sir.

Q Well, you stated that yours was 3%?

A Yes.

Q Do you have any reason to question it?

A Question the 5 or the 3?

Q Either.

A No.

Q Could that account for some of the variations that

you have just pointed out?

A Not too much, I don't think, because you have a sharp break and if you have a sharp break on that thing, it pops out there pretty fast and you are not going to lose too much, if you look on the colored AA Section, Exhibit 3.

MR. SPERLING: That is all.

MR. PORTER: Any further questions?

(Off the record)

(Whereupon there was a discussion off the record.)

MR. PORTER: We will adjourn. We will recess the hearing until 8:30 in the morning. We'd like to get started as early as possible and conclude the hearing.

(Whereupon the hearing was adjourned.)

STATE OF NEW MEXICO)
)
COUNTY OF BERNALILLO)

I, Peter A. Lumia, Certified Shorthand Reporter, in
and for the County of Bernalillo, State of New Mexico, do
hereby certify that the foregoing and attached transcript of
hearing before the New Mexico Oil Conservation Commission
was reported by me; and that the same is a true and correct
record of the said proceeding, to the best of my knowledge,
skill and ability.

Peter A. Lumia
Peter A. Lumia, C.S.R.

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