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ENFORCEMENT

DATE:

7/7/78

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

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

CASE NO. 6222
Order No. R-5753

APPLICATION OF PAUL HAMILTON FOR
SALT WATER DISPOSAL WELL SHUT-IN,
LEA COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on May 31, 1978, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 7th day of July, 1978, 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 the Texaco, Inc., New Mexico "BO" State Well No. 3 located in Unit D, Section 24, Township 11 South, Range 32 East, NMPM, Lea County, New Mexico, is an active salt water disposal well authorized by Division Order No. R-4422.

(3) That ground water in the vicinity of the subject well has been contaminated by the intrusion of brine water from an outside source.

(4) That the applicant in this case, Paul Hamilton, is the surface owner in the vicinity of the aforesaid Texaco New Mexico "BO" State SWD Well No. 3, and seeks an order from the Commission shutting in said well, alleging that said well has been and still is the source of said contaminants in the ground water.

(5) That the evidence presented is inconclusive as to whether the subject well has ever leaked injected fluids (salt water) to the ground water in the area.

(6) That recent tests conducted on said well indicate the well to be mechanically sound.

(7) That the evidence presented in this case fails to establish that the subject well is now leaking injected fluids to the ground water in the area.

(8) That the application should be denied.

IT IS THEREFORE ORDERED:

(1) That the application of Paul Hamilton for an order shutting in the Texaco, Inc., New Mexico State "BO" State SWD Well No. 3, located in Unit D of Section 24, Township 11 South, Range 32 East, NMPM, Lea County, New Mexico, be and the same 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

PHIL R. LUCERO, Chairman

EMERY C. ARNOLD, Member

JOE D. RAMEY, Member & Division Director

S E A L

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STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

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

CASE NO. 6222
Order No. R-5753-A

APPLICATION OF PAUL HAMILTON FOR
SALT WATER DISPOSAL WELL SHUT-IN,
LEA COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for reconsideration for a rehearing upon the petition of Paul Hamilton.

NOW, on this 20th day of July, 1978, the Commission, a quorum being present, having considered the petition for rehearing,

FINDS:

(1) That Order No. R-5753 was entered in Case No. 6222 on July 7, 1978.

(2) That the petition for rehearing in Case No. 6222 was received by the Oil Conservation Division from the above-named party within the period prescribed by law.

(3) That the petitioner alleges "...that recent data regarding water quality and water level obtained from an observation well completed next to the [Texaco New Mexico "BO" State No. 3] disposal well indicate the disposal well has leaked and is still leaking."

(4) That a rehearing should be held on Case No. 6222, Order No. R-5753, at 9 o'clock a.m. on August 9, 1978, in the Oil Conservation Commission Conference Room, State Land Office Building, Santa Fe, New Mexico, to permit all interested parties to appear and present evidence relating to this matter.

PROVIDED HOWEVER, That the evidence presented at said rehearing should be limited to evidence concerning the observation well referred to in Finding No. (3) above and to matters relating directly to said observation well, and to other new

evidence unavailable at the time of the original hearing of this case on May 31, 1978.

IT IS THEREFORE ORDERED:

(1) That Case No. 6222 be reopened and a rehearing of same be held at 9 o'clock a.m. on August 9, 1978, in the Oil Conservation Commission Conference Room, State Land Office Building, Santa Fe, New Mexico, at which time and place all interested parties may appear.

IT IS FURTHER ORDERED:

(2) That the evidence at said rehearing shall be limited to evidence relating to data regarding water quality and water level obtained from an observation well completed next to the Texaco New Mexico "BO" State No. 3 salt water disposal well located in Unit D, Section 24, Township 11 South, Range 32 East, NMPM, Lea County, New Mexico, and to other new evidence unavailable on May 31, 1978.

IT IS FURTHER ORDERED:

(3) That Commission Order No. R-5753 shall remain in full force and effect until further Order of the Commission.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

PHIL R. LUCERO, Chairman

EMERY C. ARNOLD, Member

JOE D. RAMEY, Member & Secretary

S E A L

fd/

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

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

CASE NO. 6222 REHEARING
Order No. R-5753-B

APPLICATION OF PAUL HAMILTON FOR
SALT WATER DISPOSAL WELL SHUT-IN,
LEA COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on August 23, 1978, and was continued to March 15, 1979, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 12th day of June, 1979, 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 the Texaco, Inc., New Mexico "BO" State Well No. 3 located in Unit D, Section 24, Township 11 South, Range 32 East, NMPM, Lea County, New Mexico, is an active salt water disposal well authorized by Division Order No. R-4422.

(3) That ground water in the vicinity of the subject well has been contaminated by the intrusion of brine water from an outside source.

(4) That the applicant in this case, Paul Hamilton, is the surface owner in the vicinity of the aforesaid Texaco New Mexico "BO" State SWD Well No. 3, and seeks an order from the Commission shutting in said well, alleging that said well has been and still is the source of said contaminants in the ground water.

(5) That upon receipt of the application of Paul Hamilton in this matter, the same was set for hearing on May 31, 1978, before the Commission.

(6) That the evidence presented at the aforesaid May 31 hearing of this case established that there is an area in the general vicinity of the subject salt water disposal well in which there is an apparent anomalous "nose" in the water levels in the Ogallala formation, and also an unnatural concentration of chloride in the ground waters in the basal Ogallala.

(7) That there was no definitive evidence presented at said May 31 hearing that the subject well had leaked or was leaking injected fluids (salt water) into the Ogallala formation in the area, or that said well was or had been a contributory factor to the aforesaid "nose" and chloride concentration in the Ogallala water, but there was evidence which indicated that the well is mechanically sound.

(8) That subsequent to said hearing the Commission entered Order No. R-5753 denying said application.

(9) That subsequent to the entry of said Order No. R-5753, Paul Hamilton filed timely application for Rehearing of Case No. 6222.

(10) That the matter came on for Rehearing on August 23, 1978.

(11) That although water levels in wells drilled to the contaminated ground water in the "nose" described in Finding No. (6) above had declined subsequent to the May 31, 1978, hearing and prior to the August 31, 1978, hearing, such decline cannot be accepted as evidence that the subject well had previously leaked and was no longer leaking, inasmuch as said decline could very well be the result of the stabilization of the ground water gradient in the Ogallala formation due to cessation of pumping "downstream" from said "nose."

(12) That in order to further evaluate the subject well and to further examine its integrity and to more definitely ascertain whether it is in communication with and leaking into the Ogallala formation, the Commission, at the August 31, 1978, hearing, ordered the injection of a traceable substance into the well and careful monitoring of a nearby observation well, and continued the case to March 15, 1979.

(13) That a radioactive material (Iodine 125) was injected into the subject well and the Ogallala ground water from the nearby observation well was monitored for approximately two months.

(14) That no radioactivity from the Iodine 125 was detected in the Ogallala ground water at any time during the two-month monitoring period.

(15) That a wide variety of tests have been conducted on the subject well, and all tests to date show that the casing, cement, and tubing in the well are sound, and that there is no channeling of salt water from the disposal zone into the Ogallala formation.

(16) That although the specific cause of the "nose" in the Ogallala water table, as described in Finding No. (6) above, and the source of the choride concentration, also as described in Finding No. (6), cannot be determined, there is no reason to believe that the continued disposal of produced salt water into the subject well is having or will have any detrimental effect on the ground waters in the Ogallala formation, and the denial of the application in this case, as decreed by Order No. R-5753, should be affirmed.

(17) That the affirmation of said Order No. R-5753 will not cause waste nor impair correlative rights, nor unreasonably endanger fresh water supplies.

(18) That in order to ensure the continued integrity of the subject well as a salt water disposal well, the Hamilton observation well located immediately southeast of the subject well should be monitored monthly for water levels and chloride content.

IT IS THEREFORE ORDERED:

(1) That Order No. R-5753, entered July 7, 1978, in Case No. 6222, denying the application of Paul Hamilton for an order shutting in the Texaco, Inc., New Mexico State "BO" State SWD Well No. 3, located in Unit D of Section 24, Township 11 South, Range 32 East, NMPM, Lea County, New Mexico, be and the same is hereby affirmed.

(2) That the applicant, Paul Hamilton, and the operator of the aforesaid salt water disposal well, Texaco, Inc., in conjunction with the supervisor of the Hobbs District Office of the Division, shall arrange to have unauthorized access into the Hamilton observation well located some 30 to 50 feet southeast of the disposal well precluded by a mutually agreeable sealing and locking mechanism.

(3) That the Ogallala water level in said observation well shall be determined within the first ten days of each month, and a water sample also taken, and the water level and chloride content of the water reported to the Division Director within ten days.

(4) That Hamilton, Texaco, and the Division's District Supervisor shall agree upon a mutually satisfactory procedure for obtaining such water levels and water samples, and the chloride analysis shall be performed in the Hobbs District Office of the Division.

(5) That jurisdiction of this cause is hereby 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

ALEX J. ARMIJO, Member

EMERY C. ARNOLD, Member

JOE D. RAMEY, Member & Secretary

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BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
MAY 11, 1978
31

COMMISSION HEARING

IN THE MATTER OF:

Application of Paul Hamilton for salt water disposal well shut in, Lea County, New Mexico. Case 6222

Before: Joe Ramey, Chairman

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the New Mexico Oil Conservation Commission:

Joe Ramey, Chairman
Emery Arnold, Commissioner
Phil Lucero, Commissioner
Richard L. Stamets, Staff Member

Lynn Teschendorf, Esq.
Legal Counsel for the Commission
State Land Office Building
Santa Fe, New Mexico

LANPHERE REPORTING SERVICE
P.O. BOX 449
56 SOUTH FEDERAL PLACE
SANTA FE, NEW MEXICO 87501

MR. RAMEY: Call next Case 6222. Application for Paul Hamilton for salt water disposal well shut in, Lea County, New Mexico.

Ask for appearances at this time.

MR. HENSLEY: Harold L. Hensley, Jr., of the firm of Hinkle, Cox, Coffield and Hensley, Roswell, New Mexico, for the Respondent, Texaco, Inc.

MR. BROWN: For the Petitioner, Donald Brown and Alvin C. Jones, P. O. Box 776, Security National Bank Building, Roswell, New Mexico, for the Petitioner.

MR. RAMEY: We have subpoena's in this case and I would like to determine if all these people are here. John Runyan, Jim Wright, Herschel Moore, Vince Balderez, Less Clements, Sherman Gallaway, John Gannon, Billy C. Jones.

(All present.)

MR. RAMEY: How many witnesses do you have, Mr. Brown?

MR. BROWN: Mr. Jones will take the lead in this thing. We have, go ahead and make the announcement.

MR. JONES: I believe every one of the subpoenas that were issued by the Commission was issued to our witnesses. We may have one or two in addition to

those.

MR. RAMEY: Mr. Hensley?

MR. HENSLEY: If the Commission pleas
the only witness we will call will be Mr. John Gannon
has also been subpoenaed by the Applicant.

MR. RAMEY: I ask that all witnesses
and be sworn at this time.

(WHEREUPON, the witnesses were duly sworn.)

MR. RAMEY: Mr. Jones, you may proceed

MR. JONES: Okay. We call Mr. Gannon

JOHN V. GANNON

the witness herein, having been previously sw
was examined and testified as follows:

DIRECT EXAMINATION

BY MR. JONES:

Q Would you state your name, please?

A John Gannon.

Q What do you do for a living, Mr. Gann

A I'm District Superintendent for Texac
Hobbs, New Mexico.

Q How long have you been so employed?

A Thirty years.

Q In Hobbs?

A Six years in Hobbs.

Q Were you served with a subpoena in this cause?

A Yes, sir.

Q Was it a subpoena duces tecum?

A Yes, it was.

Q Did you bring the records that Texaco has on this salt water disposal well No. 3?

A Yes, I did.

Q Do you have them with you?

A Yes, I do.

Q May I see them?

A (Complies.) This is a well file, normal well file. This is the lease file on the State of New Mexico BO lease and this is a file on the Moore Devonian Salt Water Disposal System.

Q Are there any other records maintained by Texaco at your office on this well?

A No, sir.

Q This is everything that you have?

A Yes, sir, with the exception of some very recent correspondence with our legal department in Midland.

Q During the last six years, Mr. Gannon, has this well been repaired in any way at all?

A Yes, it has.

Q When was this?

A On three occasions we have pulled tubing from the well. On March 24, 1974 we pulled our tubing and packer and replaced several joints of 3 1/2 inch tubing.

On February 7, 1976 we attempted to pull tubing. Our packer was stuck and we have to cut off above the packer and then wash over to retrieve the packer from the hole, after which we reran a new string of 3 1/2 inch tubing.

In February, 1978, we pulled the 3 1/2 inch tubing and packer to check their condition, found both to be in good condition and reran tubing and packer back in the hole.

Q What direct involvement do you have, Mr. Gannon, with any of these activities? Do you go to the site?

A On one occasion I did visit the site, however nearly always is done by other people under my direction.

Q Who, under your directions, is responsible

for taking care of the well?

A All wells in this field are under the supervision of Mr. A. Grenandt who is the field foreman in our Lovington field. The producing operations in this particular area under the supervision of William Zann and various drilling activity are supervisied by drilling foreman, who we have a variety of them. They may come from any area.

Also on occasion we temporarily promote people from our field forces to the position of drilling foreman to supervise this type of work.

Q Was any of this activity that you've described in regard to the well in '74, '76, '78 reported to the Commission?

A No, sir.

Q Was any of it the type of activity that you thought ought to be reported to the Commission?

A No.

Q Do you have any first hand knowledge with the circumstances that arose that required the maintenance to the well in March of '74?

A Yes, sir. It's our custom to monitor the pressures on our tubing and casing and in this instance

we had an indication that we possibly had a leak in our injection string tubing and this is what caused us to move on the well to inspect the string of tubing.

Q What are you monitoring that tells you that there may be a leak in the injection string tubing in this instance?

A In this instance the--normally the annulus between the 5 1/2 inch casing and the 3 1/2 inch tubing is filled with an inhibited fluid. And normally this fluid is pressured to make sure that the annulus is full.

In this particular instance I believe the casing annulus went on a vacuum when the injection pumps were shut down, indicated to us there was communication between the 3 1/2 tubing and the 5 1/2 casing.

Q How was this discovered? Who, on behalf of Texaco noticed this condition and reported it?

A The pumper who visits the well daily noticed this condition and report this condition.

Q Is the monitoring the movement of the gauge, what was he looking at?

A In this case he is noticing a gauge and in some instances we actually have it further checked by

pressuring on the well with a pump truck.

Q Was that done in this case?

A Not to my knowledge. In this case I believe the casing tubing annulus went on a vacuum.

Q Now you say the tubing was pulled on March 24, 1974?

A That's correct.

Q Do you know who handled that for Texaco?

A No, sir, I don't.

Q Do you have any records that would show it? Would it be in these files?

A No.

Q You have no records that would indicate who operated the pulling unit or whatever, to handle this?

A No, sir.

Q Do you have any records that indicate where the problem was?

A No, sir. Other than at several joints of 3 1/2 inch tubing were replaced. In this instance it was noted that there were collar leaks in the tubing string.

Q What was the injection pressure doing March of '74?

A The injection pressure varied depending

on the volume of water that is coming into the system. It will vary from a vacuum to approximately 650 pounds surface pressure.

Q Does it ever get above 650 pounds?

A It's possible but that's close to the maximum range, both of our injection pumps running pressure is about 650 pounds.

Q Is there any monitoring of the injection pressure on that well in March of '74?

A Yes, sir.

Q What sort of device was monitoring the injection pressure?

A Pressure gauges, I believe.

Q There are no recording strip indicators or anything as to the injection pressure on that well during that interval?

A I do not believe so in 1974, no.

Q What happened to the well in February of 1976?

A Here again, it's detected that the casing went on a vacuum and here again, we attempted to pull the string of tubing in order to inspect it and check it. In this instance the packer was stuck we couldn't unseat the

packer and it was necessary to cut off immediately above the packer and then wash over to retrieve the packer, which was done.

Q Do you have any records to indicate who handled this particular work for Texaco?

A Yes, during the latter part of the workover Billy C. Jones supervised the work.

Q Who handled the earlier phase, do you know?

A To the best of our knowledge it's R. G. Jenkins.

Q Is he still an employee of Texaco?

A Yes, he is.

Q Is he still in southeast New Mexico?

A Yes, he is.

Q What caused the packer to stick?

A This is not an unusual situation. This packer is set fairly deep in the hole, fluids that we're handling are pretty hot and these packers have a rubber packing element and often times the rubber packing element or the metalic slips that hold the packer to the casing do not retract the way they're supposed to. This is not an unusual situation for packers that have been in service

of this type would be hard to get from the well.

Q Who's pulley unit did you use on this occasion?

A In this particular occasion it was Permian Well Service.

Q Do you have any records to indicate where the problems with the tubing were on this occasion?

A No, sir.

Q Do you have any records of the number of joints that needed to be replaced on this occasion?

A Yes. In this case we installed a complete new string.

Q The entire length of tubing in the well was replaced on this occasion?

A Yes.

Q What became of the old tubing?

A It was junked.

Q How long was the well down on this occasion?

A The well was down from February 7, 1976 until April 1st.

Q Did any complications arise during this workover or is this an ordinary delay that attends the

change of t[redacted]ing in a well like this?[redacted]

A No, sir. The workover did become considerably more complicated than simply washing over a packer. After the packer was washed over we then went in to clean out the open hole section, the section in which we dispose of water. And in the process of cleaning this out we stuck a bit and drill collars and got involved in an additional washover job to recover.

Q That was the extent of the problems you had on this occasion?

A Yes, sir.

Q So the well in '76 was down for most of February and all of March of 1976, is that right?

A Yes, sir.

Q Were any leaks detected in the casing on this occasion?

A No, sir. After the conclusion of the workover, when the new string of tubing was run and this is another normal procedure, after the tubing had been run in the hole the annulus between the tubing and the casing was loaded with an inhibited fluid, the packer set and the annulus pressured to 600 pounds and it held okay.

Q Was the material circulated out of the hole

on this occasion pursuant to cleaning it out with a bit?

A Yes, sir, I'm sure there was.

Q How much material? Do you have any idea?

A No, sir.

Q You wouldn't have any idea where the material came from?

A Yes, I can speculate. The water that handles, that comes from several different sources and it comes through a rather long flow lines and a variety of treating equipment and so forth and in the process it picks up some iron with the hydrogen sulfide in the water, well normally there's some iron sulfide carried along with the water to be disposed of. And I would guess that some material circulated out of the holes is iron sulfide.

Q This in some manner collects in the bottom of the holes, is that what you're saying?

A It's possible. However, in this case we think that probably most of it came about during the work we were doing on the well. That is, some of it collects on the wall of the tubing and then the process of working on the well this was knocked loose, some of it.

Q There was no problem with the function of the well in February of '76 that brought attention to it,

just a drop in the pressure between the--the annulus between the casing and tubing?

A Yes, sir.

Q Have records been maintained of the injection pressure on this well since it began operations as a salt-water disposal well?

A I'm not sure that they have.

Q Are any records being maintained on the injection pressure now?

A Not to my knowledge.

Q It was not regularly reported to Texaco, to you by the pumper or by someone else?

A No.

Q Where did the injection volumes come from?

A We meter the fluids.

Q You don't have a recording meter of some type to read or how do you do it?

A I'm sure of that either. There are a variety of ways this can be done. One from the capacity of the pump. The other is from a summation of the well test data from the well producing into the system or the other one is metering. And I'm not sure whether we do have a meter on that system.

Q Where does the information come from that goes on the 120-A?

A This is reported to our district office by our field personnel.

Q They use those combination of methods you described of inferring saltwater production from oil production and other ways of arriving at a figure to put down on a monthly report?

A Well, sir, in some instances it's not from oil production but from test of individuals, summation of individual wells test.

Q Now the 120-A form does have a space on there for injection pressure and my understanding of the Commission's rules and regulations seems to be that's supposed to be reported along with injection volume. Do you know if the injection pressure was ever reported on this well?

A Oh, yes, yeah.

Q The practice was discontinued at some point?

A It's not reported directly to me. That is I don't have a daily knowledge of the injection pressure. But it's reported regularly by our field people to our

controllers department that prepare the forms that are submitted to the State.

Q Where is the individual located that signs those 120-A and sends them in?

A That would be Mr. Elevins who is one of my assistants.

Q He's in Hobbs?

A In Hobbs, yes.

Q On this occasion in February, can you pinpoint the date, the day of the week or rather the day of the month in February, February of '78 when you pulled the 3 1/2 inch tubing?

A Yes, sir. This was on February 7th we moved in on the well and on February 9th returned the well to injection.

Q Whose pulling unit did you use on this occasion?

A I do not know.

Q Who represented Texaco at this inspection of the tubing?

A I don't know that either.

Q You weren't personally involved in it?

A No, sir.

Q You do know that someone determined that the tubing was sound?

A Yes, this was done under the supervision of Mr. A. Gernandt, the field foreman. And whether he was personally on location I'm not sure.

Q There was no indication on this occasion malfunction of the well, is that correct?

A No, no real indication of any malfunction. But we did want to be absolutely sure. There had been some pressure variations noted on the monitor gauge on the casing. And just to be sure that our tubing was in good condition we did pull it.

Q You were aware, of course, at that time of Mr. Hamilton's claim?

A Yes, sir.

Q Does a pumper daily monitor these pressure casing fluctuations?

A If not daily, at least twice a week.

Q Does he make any written record of these or is this just something he reports?

A No, sir. He just notes and then if there is anything unusual he reports that to his foreman.

Q Have you been aware that there appeared to

be some sort of leakage out of the 5 1/2 inch casing on the ground around the well through the valve of the well head?

A No, sir.

Q Were you aware that someone was racking the ground around the well apparently regularly beautifying the site where this valve vents?

A No, sir.

Q None of this was done at your direction or with your knowledge?

A No, sir.

Q You do know that there is a gauge now installed in the end of that line of the 5 1/2 inch casing that monitors casing pressure on that well?

A I'm not sure I follow this line that you're speaking of.

Q Well, I don't know much about oil wells but there's this big thing that sits on top of an enormous flange bolted to something. It comes up and on this particular well, as I recall there's a thing going right down through the center of it and I believe there's a gauge right on top of that elbow where it makes a 90 degree bend to go down into the well.

A Yes, sir.

Q And then there's something that I would call a riser, for lack of any sophistication in this business, comes at a right angle out of the well head and in this particular well points west.

A Yes, sir, I'm with you now.

Q It has a gate valve on it, I believe, about a 1/2 inch pipe on the end. So for some period of time salt water or some fluid, looked like salt water, was coming out of that. And then as I understand within the last two or three weeks the Commission has put a gauge on that. There's a flexible line now that runs out of the end of that pipe up through a stand, there's a stand near the well and there's a gauge put up there with some cloth ribbon, just tied up there. Did you install that gauge?

A Yes, this well is equiped where we can not only monitor the pressure on the 5 1/2 inch casing, but also the pressure on the other two strings of casing. That is the 8 5/8 inch casing and the 13 and 3/8 and since the outlets that connect these casing strings are down in the cellar, it was necessary to install these risers so that we could install gauges on them, right.

Q There are two risers out there that I think

you can identify from metal tags as being on the surface and intermediate strings, right?

A Yes.

Q There's no riser out of the ground on the production casing?

A It really shouldn't be necessary.

Q Right. You just take that off the well head?

A Yes.

Q Then that gauge monitors the production string pressure now, as I understand it?

A We monitor tubing pressure, 5 1/2 inch casing pressure, 8 and 5 pressure and 13 and 3/8.

Q What I'm trying to say, there is a dial-type gauge attached to about a three or four foot flexible line and it now seems to be plugged into the end in that 1/2 inch pipe that comes off of the well head. And there's a little ramshackle metal stand on the north side of the well and this gauge has been tied up there with a ribbon or something, a dial gauge that reads 200, 300 pounds I believe, on the plus side and something on the negative side. Which I understood to be monitoring the pressure on a 5 1/2 inch.

A It might very well be.

Q If this well is working as it ought to what pressure ought there to be on the 5 1/2 inch casing?

A Well, this can vary. That annulus is filled with inhibited water as I mentioned before, and depending on the most recent work done on it this annulus can be pressured to 200, 300, 400, 500 pounds. Whatever we desire to put on it.

Q Do you know what the desire was in this case?

A No, sir. I do know that in February when the tubing was pulled and checked, then the tubing and packer rerun, the 5 1/2 casing was pressured to 600 pounds.

Q Was that done as a test or was it to remain at that pressure?

A Yeah, this is a normal practice, first to guarantee the integrity of the casing and also to check that the packer is properly set.

Q It was left at 600 pounds or it was let down or what?

A Here again, the practice varies. Sometimes that pressure is left on the 5 1/2 annulus and in other cases it's bled down.

Q What was done in this case, do you know?

A I'm not positive.

Q What range of fluctuations in this 5 1/2 inch casing pressure is considered tolerant?

A 300, 400 pounds.

Q A range from , say, zero to 300, 400 pounds back down to zero?

A Um-hum.

Q What accounts for that fluctuation, do you know?

A Well, there is a variety of things that might cause it. For one thing the fluid that we're handling in this disposal system comes from a variety of wells and the wells are pumped in a variety of ashions, that is with different types of pumping equipment. And consequently the temperature of the fluid coming from the various wells that furnish water to its sytem varies considerably.

From being pumped wells who produced relatively cool fluid to submergible pumped wells that produce hotter fluid. Then again, this water comes to this system through a long gathering system, mainly consisting of lines laid on top of the ground. And the atmospheric conditions here can change the temperature of the water. And as this temperature, the water being

injected into the well changes, why it causes some expansion and contraction of tubing string, which can affect the volume and the annulus and consequently affect the pressure.

Q You're talking about expansion from some range around a 3 1/2 outside diameter, is that what you're talking about?

A Yes, sir.

Q What temperature ranges are we dealing with?

A Yes, in extremely cold weather it's possible, depending on the conditions that exist up at the salt water disposal system, how long the water has been in storage before being transported up to the disposal tank. Or if water is coming to us from wells being pumped or pumped by submergible, the range will be approximately 100 degress Fahrenheit, the difference, maximum spread probably.

Q Is it of any significance that the well in this 300 or 400 pound pressure fluctuation would go on the negative side of the gauge? In other words, the range would include some pressure less than atmospheric backup to something over, or even perhaps less than zero?

A I don't think that's unusual because the

zone that we're disposing of water into, the Devonian, is an extremely permeable and when the pumps were shut down the tubing goes on a very strong backing and consequently the tubing string can contract somewhat, which is conceivable that you could go on the negative side on the casing.

Q How do you detect significant leaks or significant pressure differentials such as necessitated looking into the tubing on the two occasions you described?

A Well, in those instances the casing would go on a strong vacuum, that is a vacuum that's easily detectible at the surface. Whenever an unusual pressure is detected and it is suspected that we may be losing fluid in the annulus, then a pump truck is called in to fill the annulus, to repressure it to check it by positive pressure tests.

Q What is a strong vacuum? Do you have any idea what numbers you're talking about?

A No, sir. We don't often measure that in inches of water columns.

Q This comes to you through the pumper?

A Yes, sir.

Q He notes some indications of something that's reported, I would imagine, and what would that be?

A Well, that's what he would report that it's on a strong vacuum.

Q He wouldn't give you any figures, he would just say it's on a strong vacuum?

A Right.

Q Are you aware of the range of the gauge on this 5 1/2 inch casing is fluctuating around?

A Yes, sir.

Q About what range is that, as you understand it?

A From maybe zero to 300 pounds or so.

Q That's perfectly within the limits the way it ought to be operating so far as you can tell?

A Yes, sir.

Q Do you keep any record of the temperatures that this system is exposed to?

A No, sir.

Q Have any other tests on the integrity of this system been performed since about August of '77, other than the pulling of the casing you described in February of '78?

A Yes, sir. There have been a number of tests conducted on this well. The first test was in

September of 1977 and this test was conducted on the order of the Oil Conservation Commission by a letter addressed to us and signed by Leslie A. Clements, oil and gas inspector, in which he outlined the procedure to be followed in conducting this test. He also set out the procedure of notifying the Conversation Commission prior to running the test and so forth.

We did this, not only on this well, but on all wells in the field, it was a field-wide test. And we did test this well on September 22, 1977.

In this instance the test was witnessed by Melvin Crossland of the Oil Conservation Commission and we submitted this form, C-103 covering the results of that test. And our evaluation of the test was that there was no leaks in the well at that time.

Then on December 8, 1977 we conducted an injectivity profile survey. This is a survey conducted by Western Wire Line Services which consisted of tracing the flow of the fluids to be disposed of through the 3 1/2 inch tubing string and to their ultimate point of disposal.

This survey, first of all showed that there was no loss of fluid within the 3 1/2 inch tubing and there

was no loss in fluid at any point in the wellbore until after the open hole section in the Devonian had been reached.

After the radioactive material was injected into the Devonian interval, the detectors were left in place for a considerable period of time to determine if there was any channel up behind the 5 1/2 inch casing and the reports of this survey are that there was no channel and no leaks in the 3 1/2 inch tubing. And that all fluids were being injected into the Devonian zone.

Q Do you know how long the injectors were left in the bottom of the hole to detect the channeling or was that left up to the company that ran the test?

A This was left up to the company that performed the tests. However, at the rates at which we are injecting, that is in the neighborhood of 11,000 barrels per day and in this case the rate was actually was being metered and it was close to 12,000 barrels a day. A few minutes of the detectors being in place would certainly reveal any channel.

Q Any other test on the integrity of the well since this tracer?

A Yes. On March 28th we ran a series of tests.

These involved installing pressure recorders on all strings of casing and also on the 3 1/2 inch tubing. In this case we applied a pressure of 500 PSI to the 5 1/2 inch casing string.

These tests were conducted over a period of two days, three days and our conclusions from these tests were that there were no communications between any of the strings in the well.

Q Any other tests?

A On April 20, 1978 we conducted another test, very similar to the tests that was conducted in March. And this test was conducted at the request of the Oil Conservation Commission.

The only difference between this test and the one conducted in March was it was a slightly shorter duration. But in our opinion, the results were the same and it showed no leaks in any casing strings, or any tubing strings.

On May 4th we conducted another test and this was conducted in a slightly different manner. In this instance the 5 1/2 inch casing was pressured to 200 PSI and the fluid level measured in the 3 1/2 inch tubing by means of a sonic fluid sounder.

We made sonic measurements of the fluid level inside the 3 1/2 inch tubing immediately after shutting down the injection pumps. And this test showed that in the period of seven hours the fluid level inside the 3 1/2 inch casing declined from the surface to a depth of 1,550 feet.

In the meantime the pressure on the 5 1/2 inch casing remained essentially constant. And this, to indicated that there was no communication between the tubing and the casing.

We similarly pressured the 8 5/8 inch casi to 100 pounds and during the conduct of the test the pressure declined on the 8 5/8 string from 100 pounds to approximately 45 pounds. And since the 5 1/2 inch casing remained essentially constant, this indicated to us that there was no communication between the 5 1/2 or the 8 5/8

Q You have written reports on all these test

A Yes, sir.

Q Do you have copies of them with you today

A Yes, sir.

Q May I look at your copies?

A Do we have extra copies?

MR. HENSLEY: Yes, we have extra copies.

Q (By Mr. Jones) Those aren't included in the materials that we discussed earlier, those files.

A The memorandum covering the results of the test on March 28th is included. The original of the survey conducted by Western Wire Lines Services is part of the well files. The copy of the C-103, which was conducted in September, '77, I believe all of this is in the well file.

MR. HENSLEY: It's all in the files.

MR. BROWN: Whose files?

MR. JONES: I would like to simply mark the whole batch as our Exhibit 1 and made a part of this record.

MR. HENSLEY: They're all stamped individually, Mr. Chairman, but we can just make one exhibit, it would be fine. Whatever the Commission pleases on that.

MR. BROWN: Are you sure those are complete now.

MR. HENSLEY: I'm sure they are. He testified from these well records.

MR. BROWN: A different copy?

MR. HENSLLY: We can mark it, they're

identical.

MR. JONES: I don't have any more questions.

MR. RAMEY: Any questions of the witness? Are you going to recall the witness later, Mr. Hensley?

MR. HENSLEY: I don't think so, Mr. Chairman, I believe the testimony is already in the record.

MR. RAMEY: Mr. Gannon, one question. If you don't maintain pressure on this annulus between the 3 1/2 and 5 1/2 at all times some pressure, how can you be sure the well is intact, the tubing string is intact?

MR. GANNON: Would you restate that for me?

MR. RAMEY: If you don't have a continuous pressure will fluid in the annulus between 5 1/2 and the injection tubing is not under pressure at all times, how can you be sure that your tubing and packer is intact?

MR. GANNON: You have to take periodic readings. You would also have to periodically check by physically loading the annulus. But even if there were no pressure held on it, in the event that a leak developed between the tubing and casing because of the injection pressure, this would be noted at the surface.

MR. RAMEY: By that, I would take it that everyday your pumper goes by and opens the valve to see if

there is a vacuum on it?

MR. GANNON: I'm not absolutely certain about the pumper's individual procedure in these wells. He goes by the well everyday and makes certain checks. The exact procedure he uses on those checks I'm not positive.

MR. RAMEY: Any other questions of the witness?

MR. JONES: No.

MR. MENSLEY: No, no questions.

MR. RAMEY: The witness may be excused.

MR. JONES: I would like for him to remain in attendance.

MR. RAMEY: All right. Would you remain in attendance, Mr. Gannon?

MR. GANNON: You bet.

MR. JONES: We call Mr. Runyan.

JOHN RUNYAN

the witness herein, having been previously sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. JONES:

Q Would you please state your name?

A John W. Runyan.

Q What is your profession or business, Mr. Runyan?

A I'm a geologist, District 1, Oil Conservation Division.

Q How long have you been in this particular position?

A 22 years.

Q Are you familiar with this salt water disposal well No. 3 of Texaco's Moore Devonian Pool?

A Yes, sir.

Q Have you been involved in a salt water contamination study in that area?

A Yes, sir.

Q When did you start work on this?

A About August of '77.

Q What did your initial participation in this study involve? What did you do?

A At this particular time it was called to our attention that there was a possible water contamination problem existing in the motor pool on Mr. Hamilton's property. And my actual function in the contamination problem didn't begin until November 2, 1977, when we started to drill test wells in this property.

Q What did you have to do with the test hole drilling?

A The first 13 test wells were drilled or supervised the drilling was by me and in cooperation with the Water Resources Division.

Of the total wells drilled, the first 13, in other words, I help set the locations and try to find the water contamination outlet.

Q Did you find evidence of water contamination?

A We sure did.

Q Now, how did the State Engineer get involved in this stuff?

A Well, all fresh waters are under the control of the State Engineer and this is apparent oil field salt water contamination the Oil Commission is involved in.

Q Now, after the test hole drilling was completed you had some further function in this test?

MR. HENSLEY: If the Commission please, I'm going to lodge an objection at this time into the record. Because it appears to me that the Applicant is seeking to go into great detail in the contamination studies which may have been conducted by Mr. Runyan and I believe it

is apparent from the call of the Docket in the proceedings and also in the regulations and rules of the Commission that this is beyond the scope of this hearing.

There is pending in the Federal District Court of the United States a suit for water contamination by the Applicant Hamilton against the Respondent Texaco, Inc. and that is the proper form for any consideration of contamination of fresh water.

As I understand it, the sole and only scope of these proceedings is whether or not the Texaco EO Salt Water Well No. 3 is leaking at the present time, which would subject it to an order of shutdown by the Commission in order to avoid further economic loss or waste.

If there is no evidence, and I don't think there is any evidence, there certainly isn't any in the record at this time and I feel reasonably certain that there will be none of any leak at the present time, then I would suggest that this is far beyond the scope of the jurisdiction of the Commission and the scope of the call of the docket in these proceedings.

MR. JONES: I think there is going to be abundant evidence that the well has undoubtedly leaked extensively. The evidence in the record indicates nothing

has been done to rectify any condition that would account for this great deal of salt water that is out there around that well. And we will further present evidence of tests and so forth that have been testified to and introduced as exhibits are by no means conclusive as to whether or not the well is still leaking.

MR. RAMEY: Mr. Hensley, we are going to overrule your objection, and we will ask for one thing, it says Applicant alleges that said well has leaked salt water in shallow fresh water acquifers. I think that to determine that there is contamination of fresh water would be proper in this case.

MR. HENSLEY: I would like to make one response to that, Mr. Chairman for the record. I realize that the Commission has already ruled on the objection. It seems to me that if there is no evidence of any leakage at this time, regardless of what may have happened in the past, that to shutin all these producing wells on state leases, it would result in substantial economic waste. So for whatever purpose that serves I would like that to be included in the record, anything that may have happened in the past is not relevant to these proceedings.

Q (By Mr. Jones) I can't recall the question,

Mr. Runyan. I believe it was something to the effect that after the test hole drilling was completed and so forth, I was asking you what else you did in regard to this investigation?

A Well, after the 13 I took all the information and a map and a report of the information that we found from drilling the test wells.

Q Did you issue a report in January, 1978?

A Yes.

Q And in that report did you identify a substantial area of chloride contamination in the area of this salt water disposal well?

A Yes, sir, I did.

Q Did you have any conclusion in that report with regard to the source of that salt water contamination?

A Yes, sir. At that time I felt the Texaco salt water disposal well was apparently not leaking at that time but had leaked. There was indication from the information that it had leaked.

Q You, in fact, stated that that well was the source of the salt water?

A Apparent source.

Q Now there has been some subsequent test hole

drilling activity around that well, hasn't there been?

A Yes, there has.

Q As a result of this activity there has been another area of salt water contamination identified, is that right?

A Yes, sir.

Q First I'm going to mark a map here, Mr. Runyan, and we will call this 2.

I'm handing you what I have marked as 6 and ask that you look that over and tell me if that's a copy of the map that you prepared pursuant to this investigation?

A Yes, sir. This is the map that was constructed after the first 13 wells were drilled.

Q What basis did you have for concluding that the well had stopped leaking?

A The basis of the main conclusion on the chloride map is the fact that the water movement is apparently to the east and to the southeast. And on this particular map test well 12 lies some 300 feet due east of the salt water disposal well has a chloride content of 11,615. This figure is very low compared to produced water. And if the well was leaking at the time the test wells were drilled,

this particular test well did have chlorides in the neighborhood of produced water.

Q What do you mean by neighborhood of produced water?

A Well, it's a little ways off of the well and the chlorides, typically as the chlorides move away from a source of contamination they decrease in value, the chloride content does due to the fact that your salt water specific gravity is very heavy. It will tend to drop out and also you have mixing of fresh waters. Like I say in this case, this lies some 300 feet away and it's 11,615 parts per million which indicated that the well is not leaking at this time, it should have been much higher almost produced water, in my opinion.

Q I'm going to hand you another map, Mr. Runyan, it's marked 7.

MR. RAMEY: Mr. Runyan, could you tell me what the Chloride content of the produced water is?

A It varies. We have two figures, they're not quite the same. The latest figure we have from the Amarada's Unit P 14-11-32, 26,600 plus. And the other figure we have was a little over, 26,400 which was out of the salt water disposal battery.

Q (By Mr. Jones) What is Exhibit 7?

A Exhibit 7 is a final map which I prepared after the total of the 37 test wells had been drilled.

Q That includes a number by Texaco and then three more by Mr. Hamilton?

A Yes, sir. 21 by Texaco and three more by Hamilton. I was going to say there is an error on this map.

Q Is the error in the location of Mr. Hamilton's No. 16?

A That is correct.

Q It should be down there on the spur where you have your little arrow?

A Yes, sir. I do have another map.

Q That will do. Now was there an additional area of chlorides identified in this last series of test hole drillings?

A Yes, sir, there was.

Q That was essentially unknown to you at the time when you prepared the earlier maps, number 6?

A That is correct.

Q Where was this located with regards to the disposal well?

A Located south and southwest from the disposal

well.

Q What level of chlorides were found near the disposal well?

A Near the disposal?

Q Yes.

A The closest--well, 26,176 was test well, Texaco test well number 4 which is very close to the salt water disposal well. And then Texaco test well number 12, 28,613 parts per million. This is the highest.

Q Do you know where the chloride level is much higher in the ones in the sample prior to your January report?

A Yes, sir. The ones to the south were, yes, sir, quite a few were. Some were lower.

Q Did you come to some conclusion about the source of that salt water?

A Yes, sir. On this one?

Q Yes, sir, Pursuant to your latest revision, I believe that map was revised when?

A May 24, 1978.

Q That embodied the results of the last test hole drilling that you had been informed of?

A Yes, sir.

Q What did you decide had been the source of the salt water after this?

A Well, there were--apparently could have been two sources at this time. One of them was based only on rate movement and volume to water. The chloride map though again shows that Texaco Salt Water Disposal No. 3 apparently again is not leaking at this time. Again the water movement is basically east. The test wells which are drilled around the salt water disposal wells are all lower than produced water, which indicates that the well is not leaking at this time.

Q Has it ever leaked, Mr. Runyan?

A The map indicates so.

Q It has leaked rather extensively on some occasions, isn't that right?

A The map so indicates, yes. Because there is a chloride anomaly sits around the well.

Q Now that 26,178 chlorides off of No. 4 which you say is the closest to the well, that's what, about 200 parts per million off of produced water?

A About 5.

Q Now I think you said Amarada's water tested 26.4, didn't you?

A 26,600 plus. I don't remember the last two.

Q There was another test of 26,4?

A Yes, that was off the injection pumps.

Q Now you heard Mr. Gannon talk about this well this morning, didn't you, Mr. Runyan?

A Yes, sir.

Q Did you hear him discuss any mechanism which would conceivably account for all this salt water being in the ground around that well and evidently expelled from that well that's been remedied or otherwise taken care of?

A The only thing is the fact that the tubing had been replaced. He does not report any casing leak repairs.

Q If Mr. Gannon's state of affairs is to be accepted, that well has never leaked, isn't that right, Mr. Runyan?

A Well, it appears so.

Q If what he says is true, there would be no leakage at all from that well and yet it has obviously leaked extensively, hasn't it?

A Well, from the information we have it so indicates it has leaked extensively. But from his--

Q What water rate movement did you have in mind when you identified your second source of contamination?

A The rate I had in mind was water rate, which is the best we could come up with was 8.8 feet per day. This did not take into any amounts the rate at which Mr. Hamilton's well had pumped which could influence.

So the rate itself is a figure based almost on gravity without any additional outside influence.

Q Where did you get your 8/10 of a foot a day figure, Mr. Runyan? Is this something you empirically derived from--

A The State Engineer furnished this as the best estimate they could come up with with the information that was available at the time.

Q Now, have you been since advised that that estimate is not any good as far as they're concerned?

A Due to pumpage of Mr. Moore's well and also on the basis of their water level map, it indicates water rate is greater than point 8.

Q Now have you been informed of the existence of an apparent point of recharge at the location of the salt water disposal well?

A I have been informed that there apparently is

one.

Q So that would influence the rate of movement as well, wouldn't it?

A Possibly, yes, sir. I'm not a hydrologist but if it is a higher water table it would increase it somewhat. To what figure I would have no idea.

Q Now aside from the materials or the matters Mr. Gannon testified to and I assume you are aware of those from your investigation of this situation in the Hobbs office, do you know of any other reason why you can say that well isn't now leaking?

A Isn't now? From the test I'm familiar with that we're taking.

Q The pressure tests on the casing and casing surveys and so forth?

A Casing surveys, yes, sir.

Q Is that 26,178 there at Test Well No. 4 consistent with the well still leaking?

A If it is still leaking, no, sir.

Q What would the figure be at Test Well No. 4 if the well was still leaking?

A It would be approximately I would think, somewhere around 26,600 plus. I understand also there are other

wells which are pu[illegible]ng water into the sy[illegible] Pennsylvanian and they're being put into in[illegible] I understand it is stored and then moved occasionally. And Pennsylvanian water runs 50,000 to 60,000 part per million. And if this water were to be mixed it would certainly raise the chloride content periodically.

Q How precise are your chloride calculations, Mr. Runyan?

A The chlorides?

Q Yes.

A The chlorides in the wells, of course, are-- obviously cannot be lower than what we've taken but some could be higher. It depends on how well the water test wells are developed. In other words, how long they were pumped before the final chloride analysis or the sample was taken. It can vary considerably if you take a sample first, pump it for a short period of time; take another sample and that particular sample could be low unless you really developed the well and pumped it through a fair period of time.

Q This technique is fairly sensitive to the sampling procedure involved in each case, is that right?

A In this particular case it is, fairly

sensitive, although I would have to look at the chart to see how well the two samples compared to each other, the first and second, to be able to tell how well the well had developed.

Q What information have you got that any Pennsylvanian water goes down this test well, or this disposal well, pardon me?

A Well, it's the only disposal well in the pool and I believe that there is 200 Pennsylvanian wells being produced. As I understand it, from Amarada they do tank it and periodically ship it up. But it's very low rates of water, low volumes of water.

Q Someone at Amarada informed you that Pennsylvanian water is occasionally delivered into the system?

A Tied into the system.

MR. JONES: We would move the admission of 6 and 7.

MR. RAMEY: They will be admitted.

(WHEREUPON, Hamilton's Exhibit No. 6 and 7 admitted into the evidence.)

MR. JONES: That's all, Mr. Runyan.

MR. RAMEY: Any questions of the witness?

MR. HENSLEY: I have a couple of questions, Mr. Ramey.

CROSS-EXAMINATION

BY MR. HENSLEY:

Q Mr. Runyan, you indicated that you were familiar with the various tests which has been conducted on the casing surveys here to see whether or not the casing has leaked since the Commission entered its letter back in September of '77.

There is no evidence, is there, of any casing leaks on this well as a consequence of any of that testing?

A In my personal opinion, no.

Q As I understand it, your conclusion that this well has leaked or may have leaked in the past, is a conclusion which you have reached from the fact that there is a chloride content evident in close proximity of this well bore?

A Plus the chlorides did contour out and an anomaly around the well, which is really unusual.

Q What type of anomaly is there present around the well? Are you talking about an anomaly insofar as the red beds are concerned?

Q Is the slope of the red bed in this area also from west to east?

A Yes, mainly. In general it is in the immediate area.

Q Does the directional flow of water normally follow the contour of the red bed structure?

A It would strictly depend on the lithology between the surface and the red beds. And also the lithology of the material between the two. I believe up here in a particular case the bigger gravels lie on the bottom, top of the red beds and your water would tend to move through the gravel more rapidly than through a sand zone.

Q You say at the base of the Ogalala you would find your highest concentration of these gravels?

A Not the base, the top.

Q The top, okay. Where is the highest concentration of chloride?

A The highest?

Q Is it at the base?

A Yes, sir. All of the samples except some that were reentered were taken right at the top of the red bed.

Q Is this directional flow or the rate of flow

some southward movement. But apparently to what extent we don't know.

Q How do you explain that geologically or hydrologically?

A Well, the best explanation I can come up with, the Water Resource Division may have a better explanation, but I felt that the water has spilled over into the second valley across the ridge. Some more test wells were drilled on this particular high, south of the salt water disposal well I feel that we would find some more chloride value between test well 12 and 13.

Q If any water spilled over the top of the ridge the chloride concentration in that water being in the uppermost part of the Ogalala would be only slight compared to what it would be at the base of the Ogalala, isn't that correct?

A Well, in all the well tests we do, we always find out that the chloride content as you go up the hole decreases in any particular test well.

Q So if you tried to explain any flow in a southerly direction from the basis of a spill over ridge, you wouldn't expect to find very high chloride readings, as a consequence of any overflow?

ridge.

Q Have you examined the structural conditions on that ridge?

A Not very closely because they were contouring at the time we were looking at it.

Q So the actual structural contours on that ridge would have a lot to do with either supporting this theory or disapproving it, this theory of overflow?

A I believe it would.

Q In your experience as a geologist, Mr. Runyan, are you able to say on a basis of expert opinion, that the disposal well such as this BO No. 3 well ever had experienced a casing leak, that that leak would not have repaired itself of its own volition, it would have had to have mechanical repairs in order to remedy any defect?

A Well, I'm not too sure about how this whether it could or couldn't being a geologist and not a petroleum engineer. I don't, in my personal opinion think it could, but it could be possible I imagine for some material to come in and to block.

Q You don't know of any such circumstance?

A Personally, not offhand.

MR. HENSLEY: I pass the witness.

A Okay, sir -- I interpolated graphically. I did not eyeball, as you -- pardon the statement, the position of those contours -- I actually took and determined graphically exactly where the contours should fall and I did this on purpose in order to get away. This is a graphical solution to get away from the possibility of misguessing where the contour would go. Ordinarily I might say, Mr. Hensley, I do each contour this way. But I did it on purpose this way because of the fact that we did have--it appeared to be an anomalous condition and I wanted it pretty well established where those contours should go.

Q Have you revised that contour of the red beds in the last two or three weeks or has this been your interpretation for some period of time?

A This water table, I might say, sir, this red bed map here was completed Monday night. I was drawing this map--I drew this map up Monday afternoon, Monday night. The water table map was drawn a couple of day before.

By my saying these two maps reflect the data that was available through a week ago yesterday.

Q Okay. Does presence of chloride in the water volume affect the water table?

A Well, certainly--well, first of all I would

like to point out that the chloride is a measure of sodium in the water. It's a measure of something else. But certainly if the reflection of the amount was salt in the water, basically in most cases, and of course, when you have water as you increase the salt content of it, the density of that water increases.

Q Okay. Did you make a correction on these contours for that density?

A No, sir, I did not.

Q What's the effect that that's going to have on this interpretation of the bulge being present?

A Inasmuch, sir, as the salt water is on the bottom of the formation and these contours--they're on the base of the water bearing formation and my contours are on top of the water bearing formation, on top of the water bearing part of the formation, that means that the salt water is separated from this map by some 40--something like 45 feet of saturation, sir, in this area.

Q I thought you had already indicated that there's a general area of radial mix. It's not all concentrated in the base?

A But when you inject water into that formation sir, when it goes into that formation you're adding water

in the vicinity of that well and certainly you're going to mound the water table in the vicinity of that well. The salt water, because of its density tends to concentrate on the bottom of the aquifer.

Q If I understand your mapping of the red beds, this salt water disposal well, I believe you indicated in the course of your direct testimony, is located on the south side of the northeast trending valley?

A That is correct, sir.

Q Isn't it a fact that you would normally, under those topographic conditions expect your rate of flow, considering the general characertistics of the Ogalala, in the area to flow from a west to an easterly direction?

A Fresh water, sir or salt water?

Q I'm talking about fresh water.

A The fresh water, the general movement of fresh water is generally east-southeast in this area.

Q Are you suggesting that the flow of any saline water would be in a different direction?

A Normally with the configuration of the red beds that we have, I would expect as the saline water settled to the bottom of the red beds, not the red beds, as it settled down to the top of the red beds to the base of the

Ogalala formation, I would expect that water to more or less follow the drainage lines that were developed on that erosion surface. In other words, basically when that water settles to the bottom, because of its density settles to the bottom of the formation, I would expect it to move out of the area, say, in that direction. Basically I have a line coming out right there. These red lines, these are the low points in the red beds.

I would expect the densest water to fall along those lowest points in the red beds.

Q Geologically and hydrologically there would no reason in the world under normal circumstances for that water to take any course other than the course of the Ogalala fresh water reservoir trend?

A You can have the red beds--you can have movement of water, sir, due to density that is different from the movement of water due to the general hydrolic gradient.

Q But there is no evidence that that's occurring here, is it?

A With the concentration of salt that we have in this water I would expect the salty water at the base of the formation to follow the low points in the red beds. The

fresh water, of course, is going to sweep on through in a generally east-southeast direction. But I think, and it's been my experience in working on other contaminated--contamination problems that basically the salt water goes to the lows in the top of the red beds and follows those down, not necessarily in the direction of the general movement as shown by the general water table in an area.

Q Let me now direct your attention to what has been marked as Exhibit 10. Is that the map of the top of the red beds or is that Mr. Runyan's map? I'm sorry, 10 is Mr. Runyan's map.

A This one over here, sir?

Q Yes. Did you have any input in the preparation of those contours, floride contours?

A No, sir.

Q You indicate that it shows the distribution of chlorides in the vicinity of the wellbore of the dispoal well?

A Yes, sir.

Q There's a distribution of chlorides elsewhere too?

A Yes, sir.

Q You indicated that, in your opinion as an

expert, that there was some general agreement, I believe you said, between the distribution of the red beds and chlorides, what do you mean by that statement?

A I don't recall saying as a general agreement between the distribution of the red beds--oh, okay. Let's take, I have superimposed these drainage levels. These are merely the bottom of the trough. For instance, okay, let's take this line right here. That's the point connecting the lowest point in that trough is up here around the area in question.

Right here I have a line that goes through there, this line right here that follows the lower part of that trough. But basically when water in this general area, now this whole area, water tends to move up around this way and then sweep down, there's two draws. There's a draw down here and tends to come down these draws. I might point out the reason for that. This right here is one of Mr. Hamilton's irrigation wells.

But in general the red beds in this area, the drainage is like this and this is the general pattern that the chloride distribution follows.

Q I believe that you also answered that question in terms of--I believe that you said if there was a discharge

chlorides in the vicinity of this well that that would be consistent with these readings with respect to higher reading in chlorides.

A Yes, sir.

Q But that doesn't necessarily mean there has to be a discharge of chloride. All I mean is that if there was it would be a consistent geological interpretation, is that not true?

A Well, sir, there has to be somewhere in the vicinity here, there has to be a discharge of very saline water into the Ogalala because the chloride content of the normal--chloride content of uncontaiminated Ogalala water is generally less than 50 parts per million.

Q Yes. I understand that.

A And now I come up with a closed contour basis that Mr. Runyan has drawn, this is his work. He comes up with a concentration of the vicinity of this well of 25,000 and more.

Q Which again requires radial distribution to the south and west, assuming that this well had anything to do at all with the source?

A No, he shows a fairly--the way the contour shapes there is a considerable volume of highly saline water

Q Does this give an initial bottom hole pressure?

A Yes, it does. It's 4,099 feet. This reservoir is an active water drive and Mr. Gannon quoted my calculations. With an original bottom hole pressure of 4,099 feet and with the water that you have right now could drive 1.031 gives you a fluid gradient of .446 pounds per foot, which if calculated out this reservoir pressure would hold a column a foot of 9,191 feet from the reservoir back, which means the fluid would stand within 1,589 feet of surface. They say this morning that they run a test and at seven hours it dropped down to 1,500 supports my theory.

And you know the water is approaching from the southeast in this cause it's an active water drive and it's already flooded this well out. And in an active water drive like this type of reservoir you will sustain the original bottom hole pressure. This is from a reservoir standpoint. And it's very easy for water to communicate around out in the pay and come back up in this well.

Now let's go back to this theory on the casing. Now this is going back on these wells for ten or fifteen years and not find a cement job on these things. Cement got contaminated and never did set up. In fact, I run into one last year, a man fractured treated 8,000 feet

from his plugged hole and it blew out and had cement all over on the ground out there and it was still soft. And I have been back in the wells, myself, in Texas and in other areas here in New Mexico and found they did not have cement jobs that never did set up. It would be very easy to communicate between casing or go up in communications and then throw it out.

But I would say it wouldn't be unnatural because if you get down 700 pound pump pressure, you have to look at this and I'll go back over this. In the reservoir pressure the fluid was 1,589 feet, when you're pumping you would have a column of 1,570 feet which would put the top of the fluid at 10,761 feet or 19 feet from the surface which is above the Ogalala.

Another thing, if this well were to go on vaccumn I say it definitely has a channel around it. There's only one way--cause the reservoir pressure being as high as it is the water will not go into the formation, it's got to go on the path of the least resistence. I could not put no validity into this log whatsoever.

Q Are there any tests that you know of that can be run on this well that hasn't already, that would determine whether or not it is channeling behind the casing?

A There's a possibility of running a temperature survey wich would give you much more accurate information, in conjunction with this plus a noise tool. At this time I couldn't say whether the well was channeling or not. It could very easily be channeling.

Q You heard the testimony with regard to the pressure that was being used in this casing integrity was being tested. Is a 500 pound pressure, in your opinion, sufficient--

A No, it's very inadequate. The first thing you're injecting, from my information, around 700, now you told me this morning you had evidence they were injecting 700.

Q I believe that it states on that tracer.

A They didn't even check the pressure of the injection system.

Q What pressure is customarily used?

A Normally, 1500 to 2000 pounds when they in to check packers and casing for leaks. But there's a possiblity that you may have a hole in this, you can open it up and it will close up on you. I've run into this many times. Try to get in, wouldn't take it at 500, get above that and I'll start having communications around.

MR. RAMEY: Mr. Hensley?

CROSS-EXAMINATION

BY MR. HENSLEY:

Q Mr. Joy, as I understand your first answer to the first question, it's your opinion that this tracer log is incomplete, is that what you said?

A Definitely.

Q You don't know what it means?

A I don't know, no.

Q So what you're saying is, in effect, that Wire Line Services, who was asked to perform this tracer survey for Texaco at the request of the Oil Conservation Commission of New Mexico, failed to discharge a proper test?

A That's correct. And I find the interpretation to be wrong in the past and have sat down with the engineers and gone over with them and changed their opinion on it.

Q The balance of your testimony relates to various defects or possibilities that might have occurred, although you don't have evidence on it?

A You could have channeling also by natural fractures up there or stimulated fractures in the reservoir, you don't know how many these zones are fractured out there. It's a highly faulted area.

Q You're just speculating, aren't you?

A I'm not speculating, I'm going by reservoir engineering. I've been a reservoir engineer for nine years.

Q Well, but fracturing is unique to every specific area?

A Well, if you've got proof that the area is faulted, it's a geological interpretation here. You've also got the reports that says the formation is highly fractured.

Q What formation lies immediately above the Devonian in this area, do you know? Tell me about the verticalAfractures?

A I don't know that any other formations are fractured up there. I'm just going along with you, I'm saying that they could be.

Q They're not, are they?

A I don't know, if you--how far this fault stand up, if it goes above the Devonian. Above the Devonian you will have the Mississippian, above that you will have your Wolf Creek, the San Andres, the Yates.

Q Did you investigate these situations in the zones above the base--

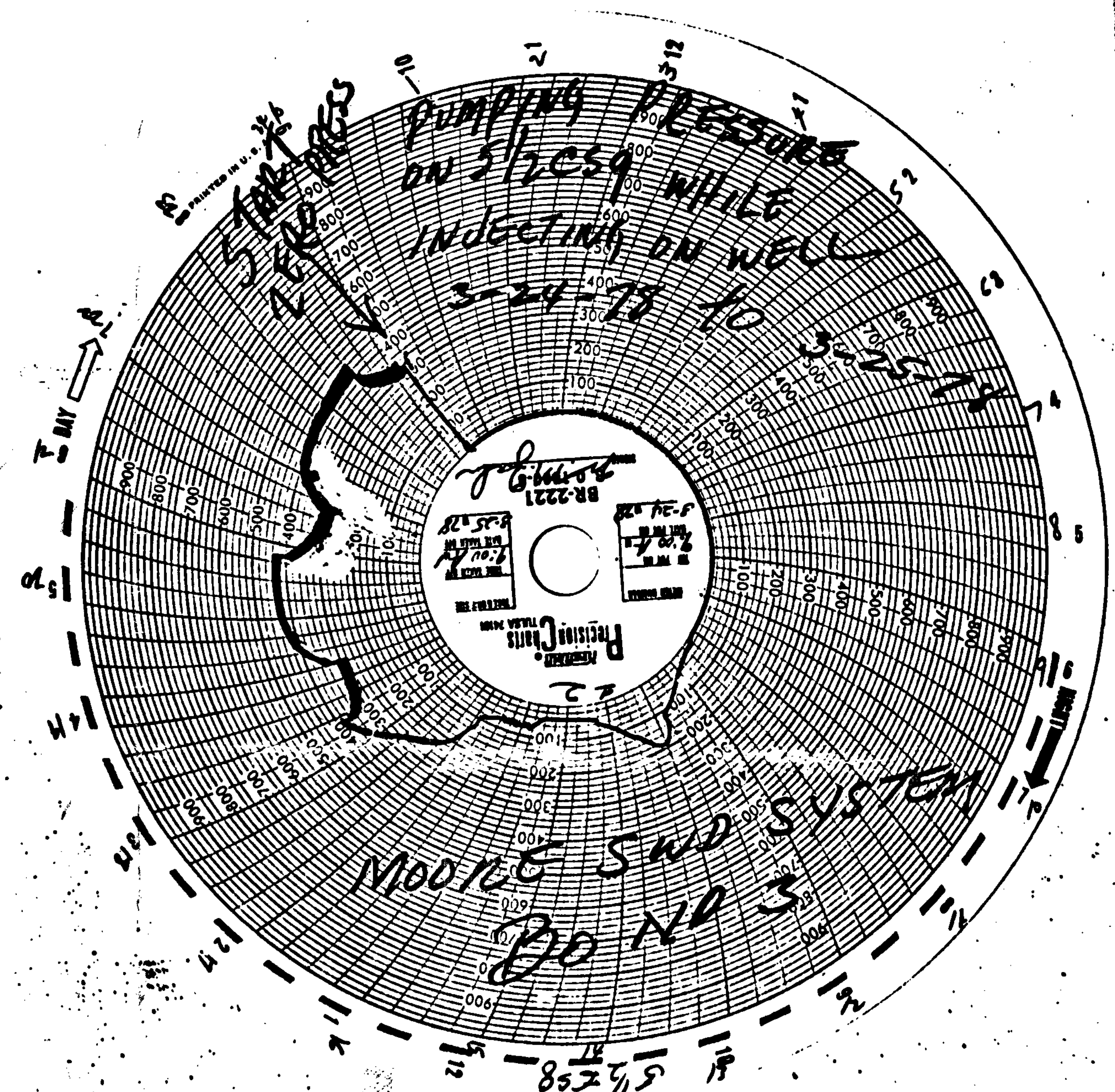
A I don't think anyone has ever recorded those

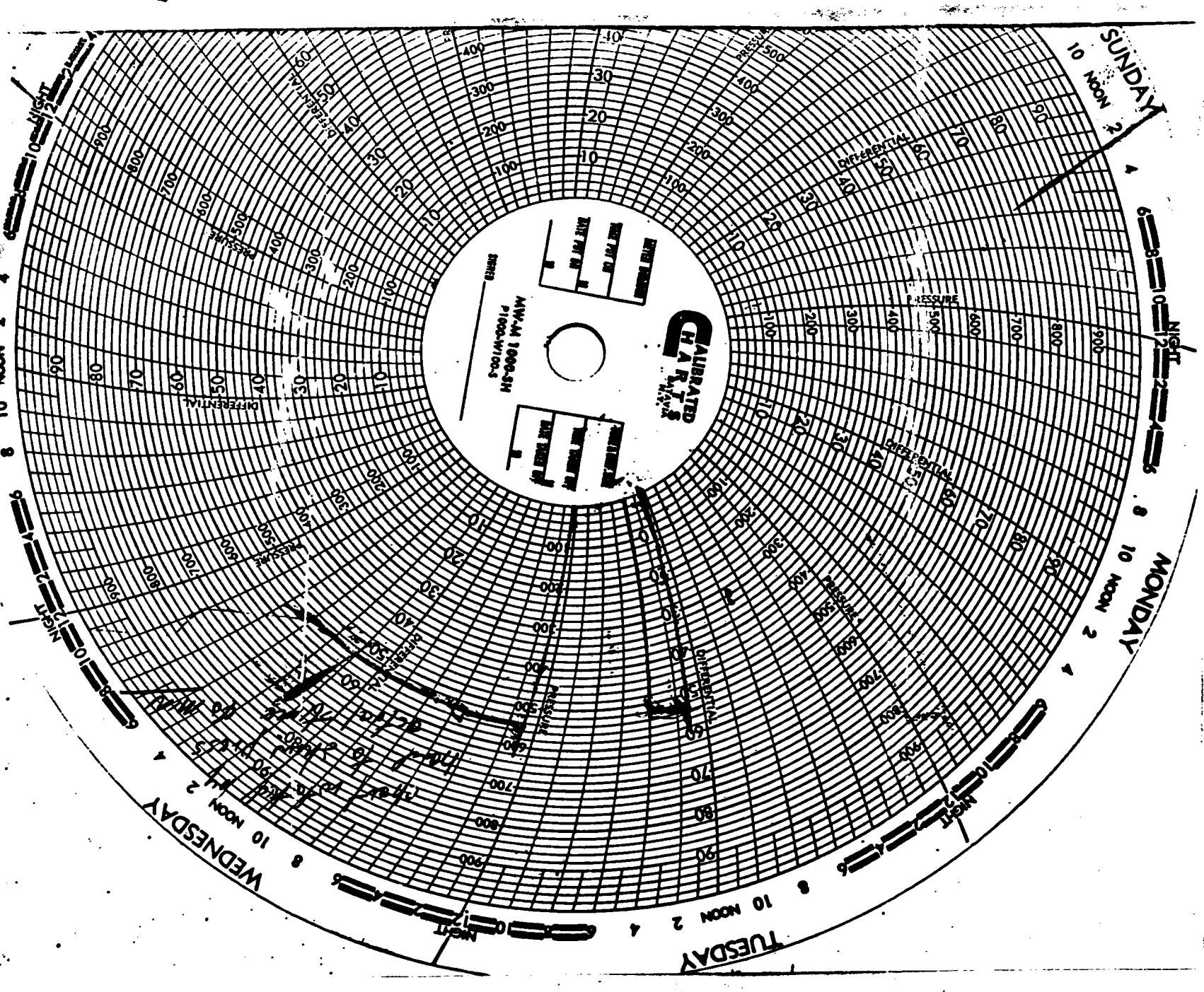
CASE NUMBER

6222

LARGE

EXHIBITS


PUMPING PRESSURE ON 5 1/2 CSG WHILE INJECTING ON WELL
3-24-78 TO 3-25-78
START ZERO PRESS
BR-2221
MOORE SWD SYSTEM
BO NO 3
5 1/2 CSG


SUNDAY
MONDAY
TUESDAY
WEDNESDAY
NOON
NIGHT
PRESSURE
DIFFERENTIAL
CALIBRATED CHART
MW-M 1000-SH
P1000-W100-S

TEXACO

bs, New Mexico, March 28, 1978

S-2 MOORE DEVONIAN SWD SYSTEM
N. M. "BO" State Well No. 3
Casing Pressure Test

Casing test of March 23-25 1978.

Mr. D. T. McCreary (LAH)
Midland, Texas

From March 23 through 25, Texaco completed a series of bradenhead well tests on the Moore SWD System's injection well N. M. "BO" State No. 3. The procedure was as follows:

1. Pressure recordings began with the system shut in. Pressure recorders were on all casing strings (5½", 8-5/8", 13-3/8") and the 3½" tubing string.

2. A pressure of 500 psi was applied to the 5½" casing string alone at 12:30 P.M. on 3-23-78. This pressure showed a slight reduction to 400 psi in 75 minutes. There was no pressure reaction on either the 8-5/8" or 13-3/8" casing strings which remained at zero pressure during this period.

3. The 5½" casing pressure was released at 1:45 P.M. and allowed to drop to zero. Then injection was started down the 3½" tubing and continued until 4:30 P.M. (3-23-78) at which time the system was again shut in.

4. At 4:30 P.M. (3-23-78) a pressure of 500 psi was again applied to the 5½" casing. All other strings showed zero pressure. The system was left shut in until 9:00 A.M., 3-24-78. The 3½" tubing, 8-5/8" casing and 13-3/8" casing did not vary from a zero pressure reading during this period. The 5½" casing showed a gradual bleed off to 340 psi by 2:00 A.M. (3-24-78). The 5½" casing pressure then remained steady at 340 psi until the end of the test at 9:00 A.M.

5. The injection system was restarted at 9:00 A.M. on 3-24-78, and pressures were recorded on all strings until 9:00 A.M. on 3-25-78. The 8-5/8" and 13-3/8" strings remained at zero pressure throughout this period.
The 3½" tubing pressure fluctuated according to normal operations, depending upon how many pumps were operating and the water level in the water tanks. A maximum pressure of 780 psi was recorded on the 3½" tubing during most of the period 9:00 A.M. to 8:15 P.M, on 3-24-78.
The 5½" casing pressure remained at zero from 9:00 A.M. until 8:15 P.M. (3-24-78). Fluctuations occurred from that time until the end of the test at 9:00 A.M. (3-25-78) because of changes in the rate of water injection caused by one of the pumps shutting down periodically due to low water level in the tank.
The injection water has a temperature of approximately 180°F and causes expansion of the tubing string during injection operations. The maximum pressure on the 5½" casing string was 430 psi.

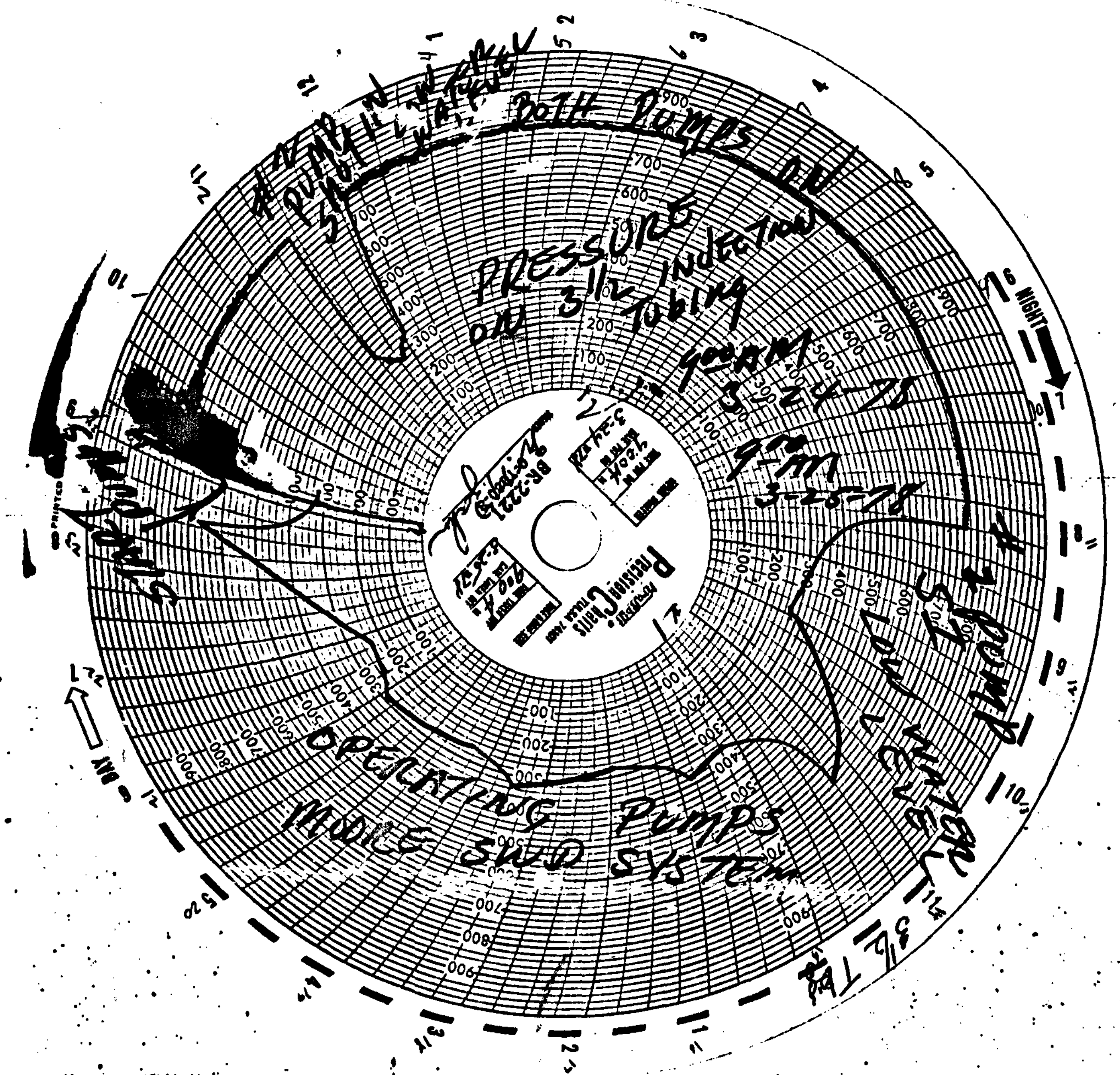
We conclude from this test that there is no communication between the tubing and casing strings.

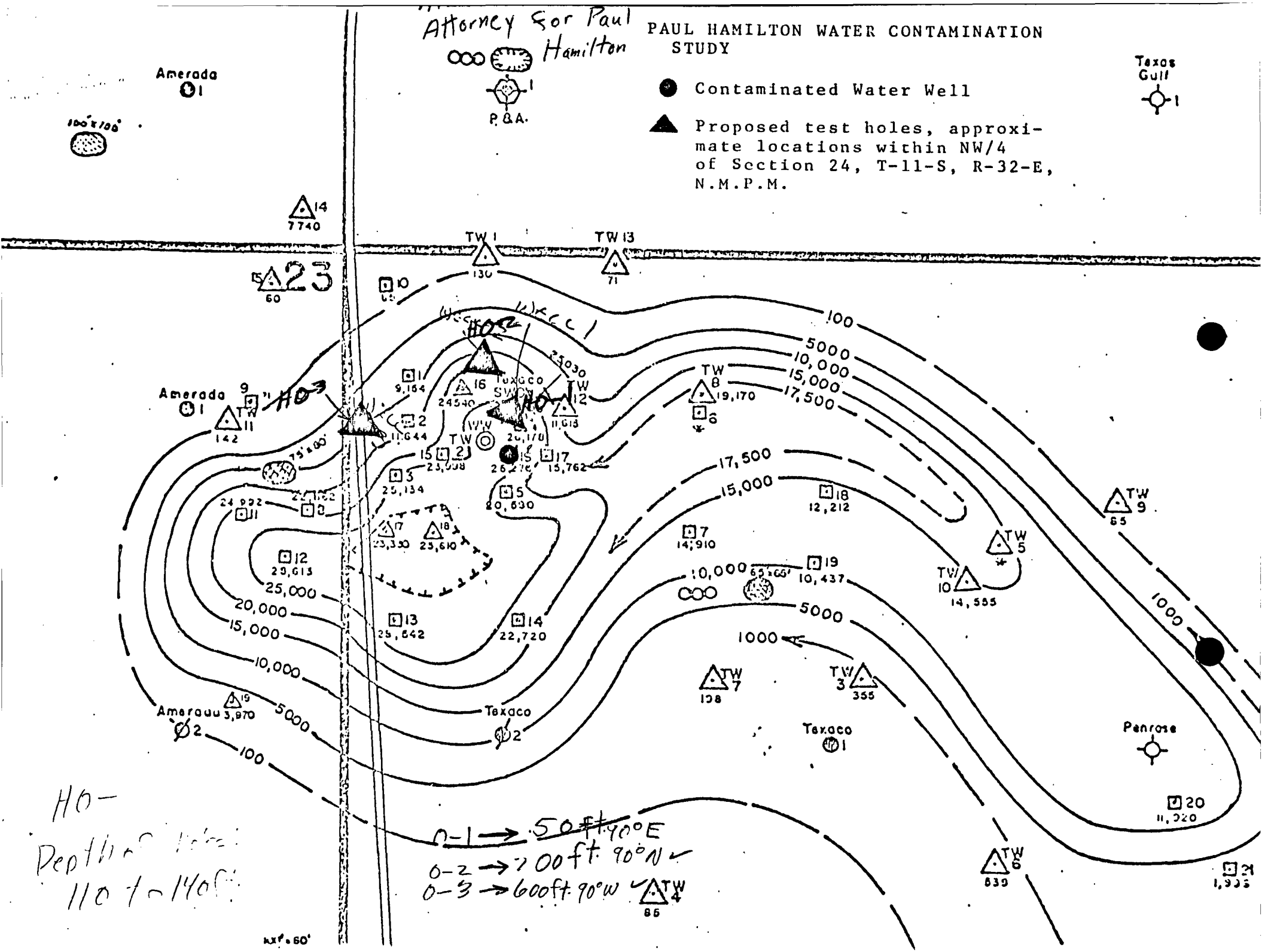
J. V. GANNON

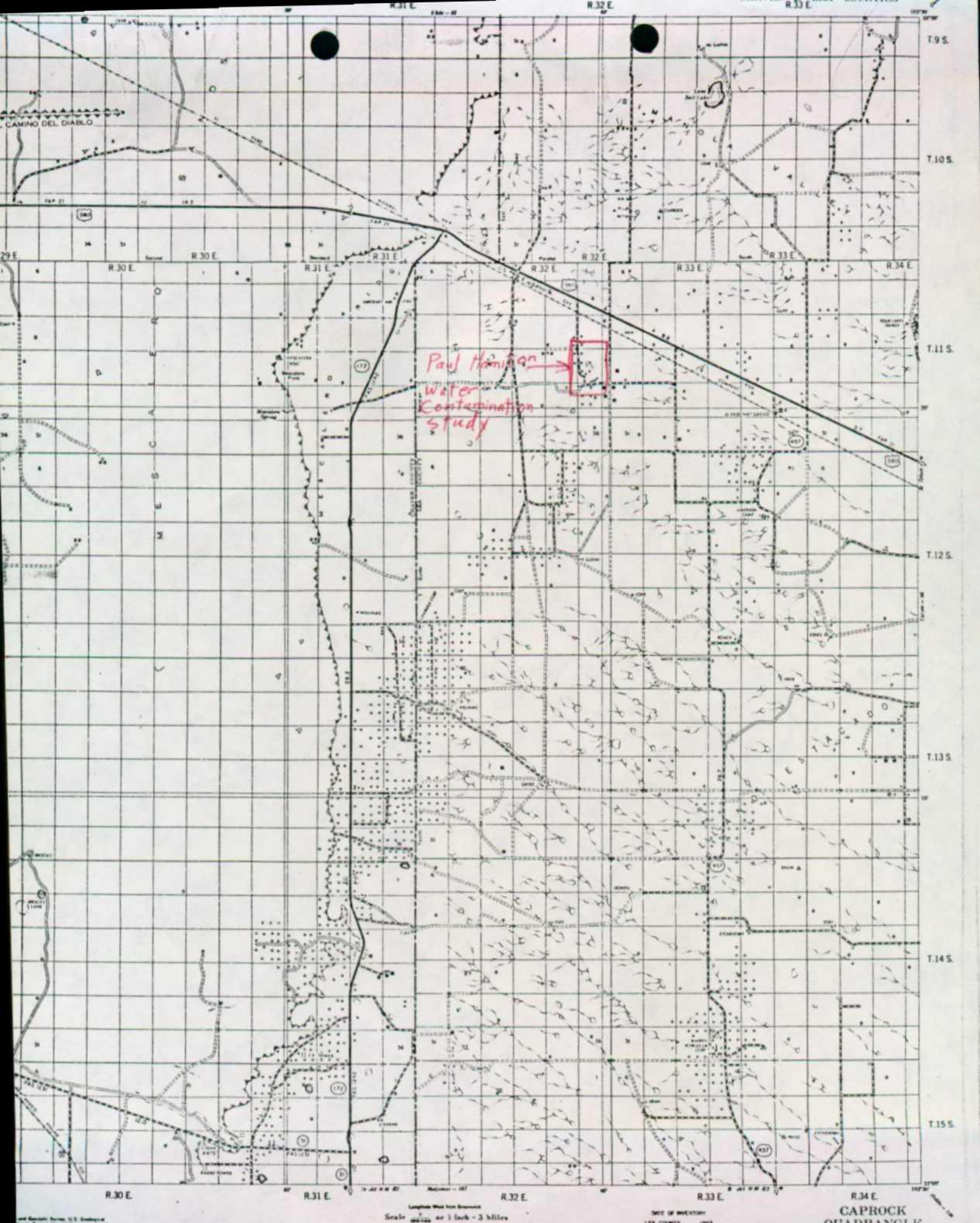
J. V. GANNON

SES:las

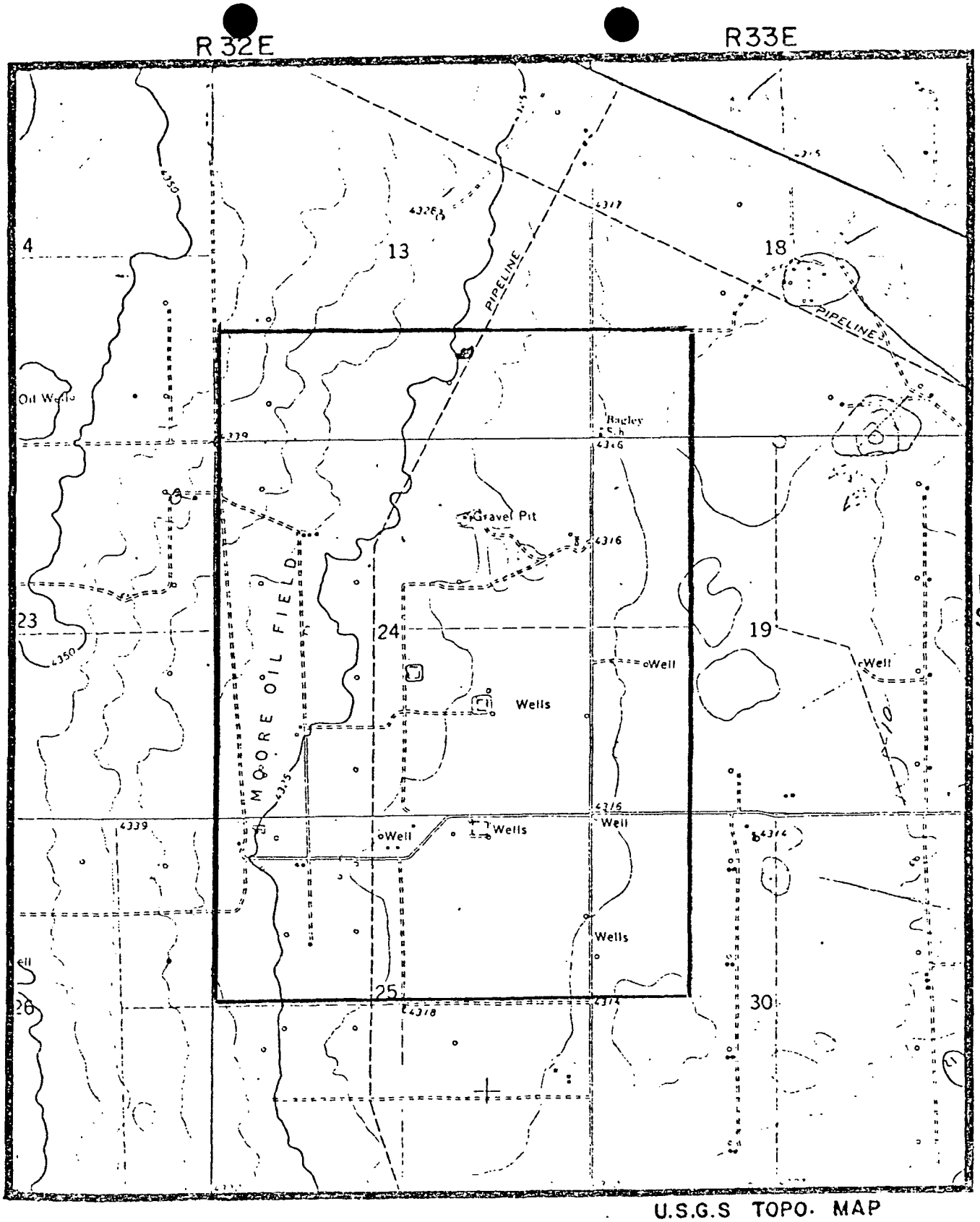
BEFORE THE
OIL CONSERVATION COMMISSION
New Mexico
Case No. 6222 Exhibit No. 3
Submitted by PH
Hearing Date 5-31-78


BOTH PUMPS ON
PRESSURE ON 3 1/2 INJECTION TUBING
9:00 AM 3-24-78
9 PM 3-25-78
OPERATING PUMPS
MOORE SWD SYSTEM
NIGHT
DAY


Attorney for Paul Hamilton
PAUL HAMILTON WATER CONTAMINATION STUDY
Contaminated Water Well
Proposed test holes, approximate locations within NW/4 of Section 24, T-11-S, R-32-E, N.M.P.M.
Amerada
Texas Gulf
P&A.
100'x100'
TW 1
TW 13
TW 12
TW 11
TW 8
TW 9
TW 5
TW 10
TW 7
TW 3
TW 6
TW 4
Texaco
Amerada
Penrose
100
5000
10,000
15,000
17,500
25,000
20,000
1000
H0-
Depth of Holes
110 ft - 140 ft
0-1 → 50 ft. 90°E
0-2 → 700 ft. 90°N
0-3 → 600 ft. 90°W



CAPROCK
QUADRANGLE
95

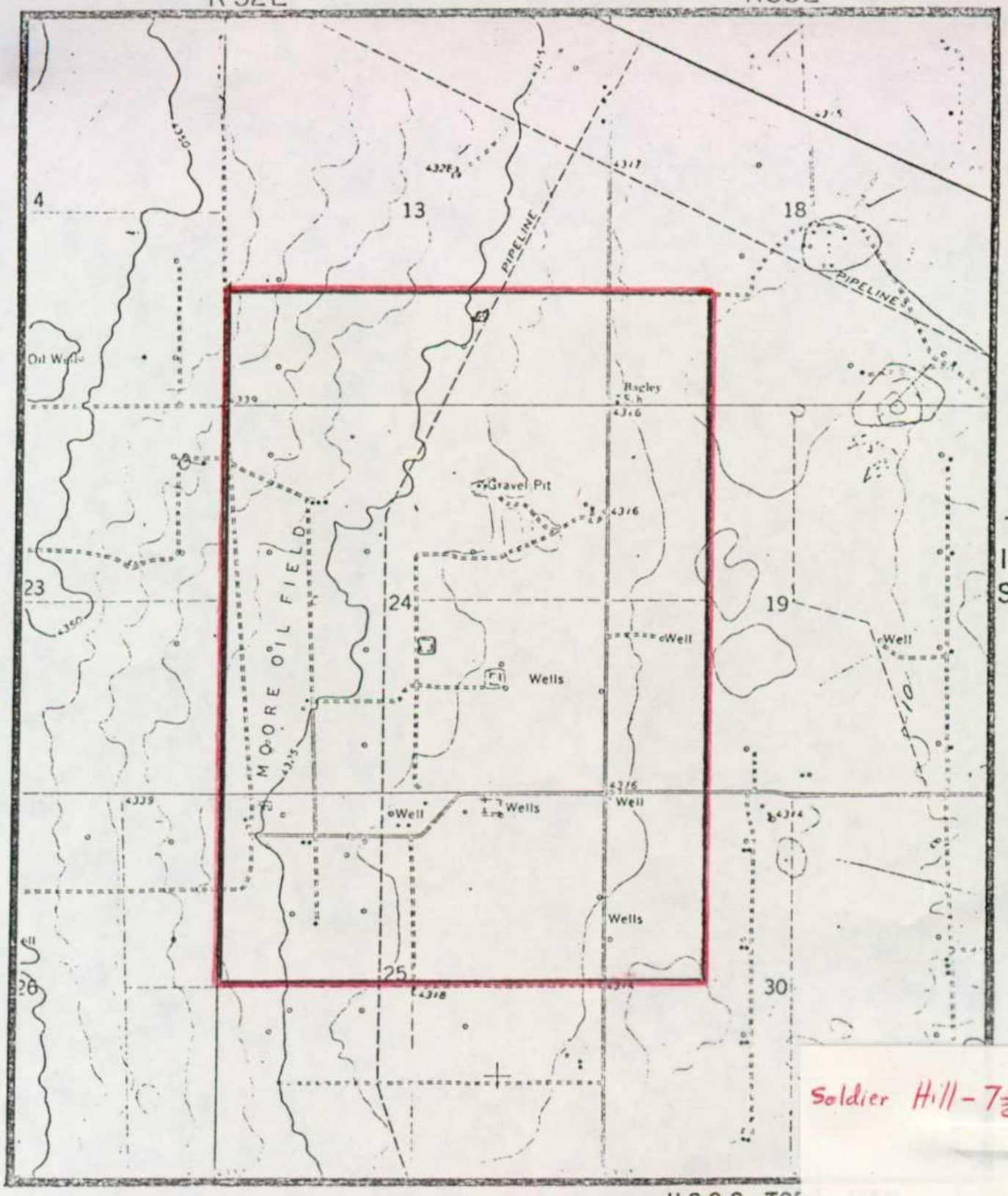


U.S.G.S TOPO. MAP

PAUL HAMILTON WATER
CONTAMINATION STUDY

—Area of study.

From Soldier Hill — 7½' Topo. Map



PAUL HAMILTON WATER
CONTAMINATION STUDY

Soldier Hill - 7½'

Figure 2.

—Area of study.

Soldier Hill - 7 1/2'

Figure 2.

Texaco BO State #3
D-24 11S-32E
Lea Co.

13⅜" @ 318'

13⅜" Casing
cement circulated

8⅝" @ 3504'

8⅝" Casing
Cement circulated

2½" Tubing

5½" Casing

Cmt top 7910'

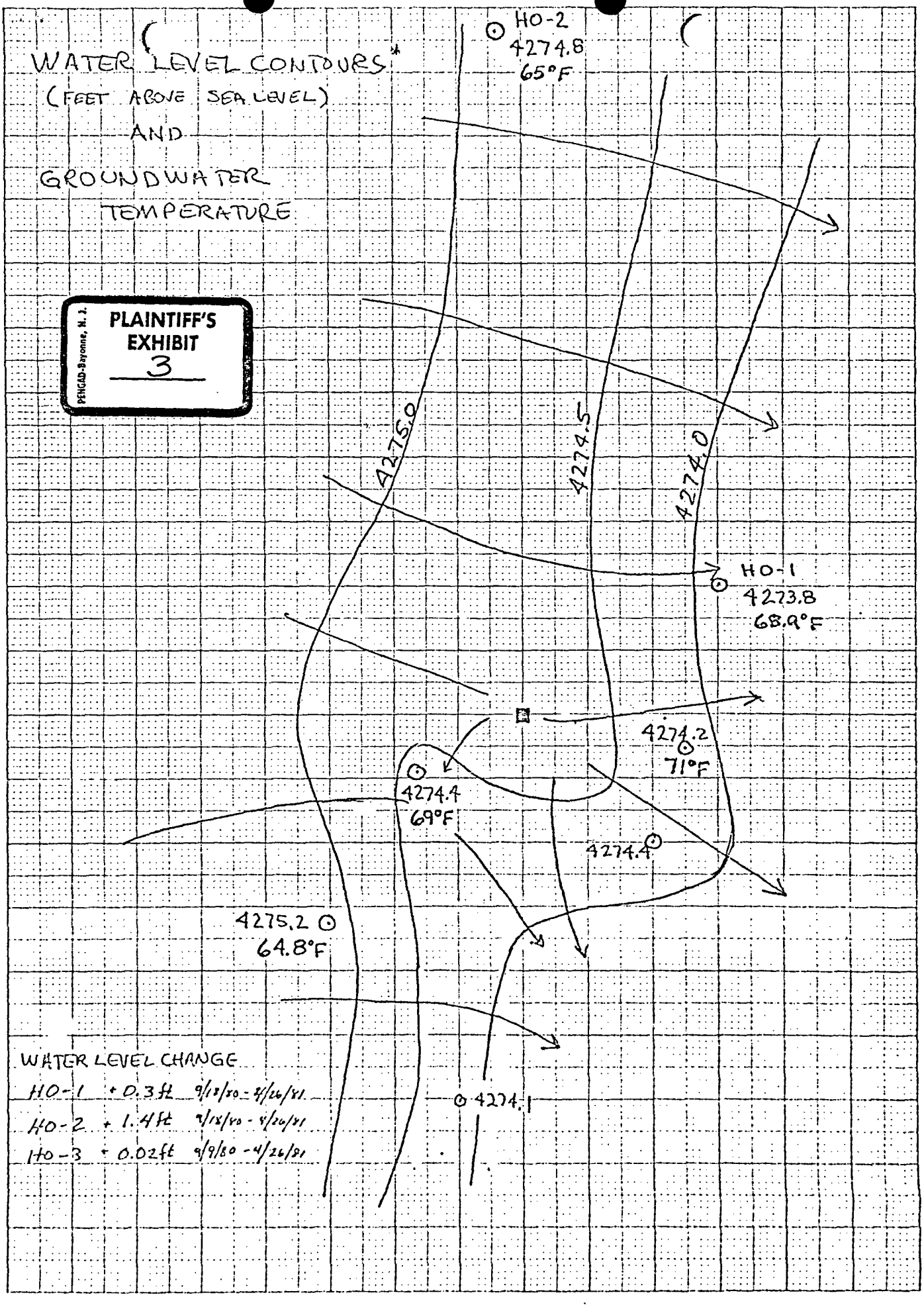
2½" Tubing set in
Packer @ 8660'

Orig. perforations 10,536'-10,566' squeeze-
cemented upon conversion to disposal

Orig.
TD 10,600'
5½" @ 10,600'

Cement w/ 600 sacks
Top of Cmt @ 7910

open hole disposal zone 10,600'-10,767'


WATER LEVEL CONTOURS*
(FEET ABOVE SEA LEVEL)
AND
GROUNDWATER
TEMPERATURE
PLAINTIFF'S EXHIBIT 3
PENGAD-Bayonne, N. J.
HO-2
4274.8
65°F
4275.0
4274.5
4274.0
HO-1
4273.8
68.9°F
4274.2
71°F
4274.4
69°F
4274.4
4275.2
64.8°F
4274.1
WATER LEVEL CHANGE
HO-1 + 0.3 ft 9/18/80 - 4/26/81
HO-2 + 1.4 ft 9/18/80 - 4/26/81
HO-3 + 0.02 ft 9/9/80 - 4/26/81

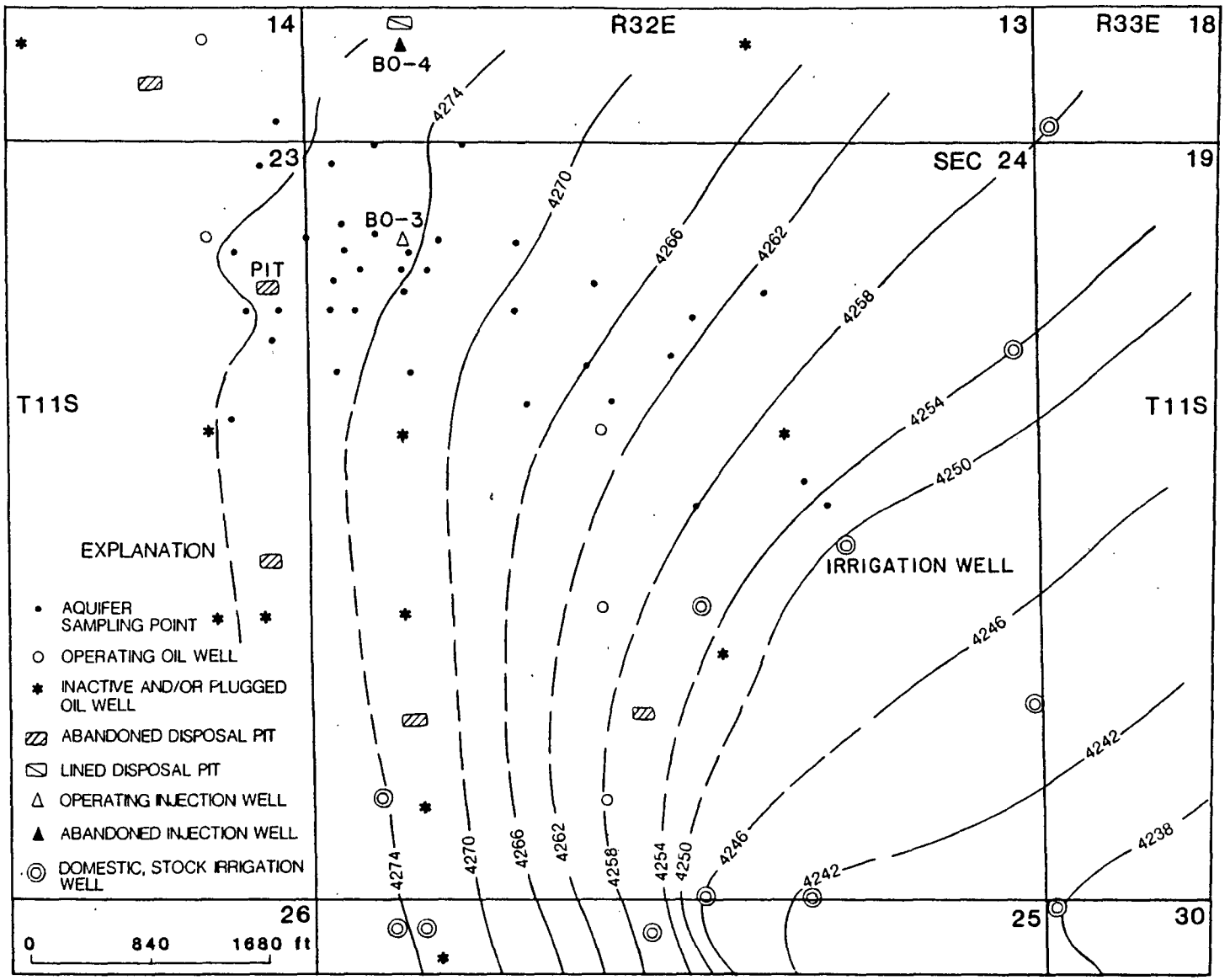


Figure 1. Water table contour map May 27, 1978 and well locations (modified from S.E. Galloway, NM State Engineers Office, Roswell)

quarter mile to the south, BO-3, in the northwestern corner of section 24, was then converted to a salt-water disposal well (Figure 1). Construction details of the converted oil well BO-3 are given in Figure 2; these are essentially the same as BO-4. From October 1972 through July 1977, approximately 20 million barrels of salt water were injected through BO-3 into the Devonian formation at a depth exceeding 10,500 feet (Evelyn Downs, personal communication, NMOCD, 1984).

An irrigation well, completed in 1973, approximately 3900 feet (1190 m) southeast of BO-3 injection well began producing water from the Ogallala with a chloride concentration exceeding 1200 mg/l in July 1977. Crops irrigated from this well were severly damaged and the bank soon foreclosed on the farm property. There was no evidence of crop damage prior to 1977, and it is assumed that ground water quality at this well was near background, which is less than 100 mg/l chloride.

Test drilling and sampling from 1977-1978 (Runyan, 1978a,b) showed that there was a plume of saline water which appeared to originate in the northwest corner of section 24 and the northeast corner of section 23 (Figure 3). The highest concentrations of chloride occurred around the BO-3 injection well and southeast of the abandoned brine disposal pit; in places these concentrations were more than 100 times the recommended drinking water standards. The hydraulic gradients indicated in Figure 1 suggest that the probable source of contamination was either the old pit or the BO-3 injection well. Average ground-water flow velocity is on the order of at least a few hundred feet per year, on the basis of hydraulic conductivity and effective porosity data obtained from an aquifer pumping test near BO-3 (Water Resource Associates, Phoenix, written communication, 1982), irrigation well performance data (NM State Engineer Office, Roswell, NM, open file records), and hydrogeologic reports (Ash, 1963; Haven, 1966; Nicholson and Clebsch, 1961). Assuming a simple solute-transfer model, saline water from the pit which may have entered the Ogallala shortly after 1958, should have travelled well beyond the irrigation well in question by 1977.

A ground-water monitor well completed in 1978, near the base of the Ogallala, 60 feet southeast of BO-3,was sampled and analyzed. Figure 4 shows that in this well, sampled over a two year period, ground water had a chloride concentration which was generally similar to the injection water, except for the obvious peak. Moreover, the chloride concentration in this observation well was relatively unchanged over nearly a three to five year period when compared with data in Figure 3. Unless there was a subsurface barrier inhibiting saline ground-water movement, or a continuous source of saline water introduced to the aquifer, fresh ground water should have displaced much of the contamination from the vicinity of BO-3.

On the other hand, there is also evidence which suggests

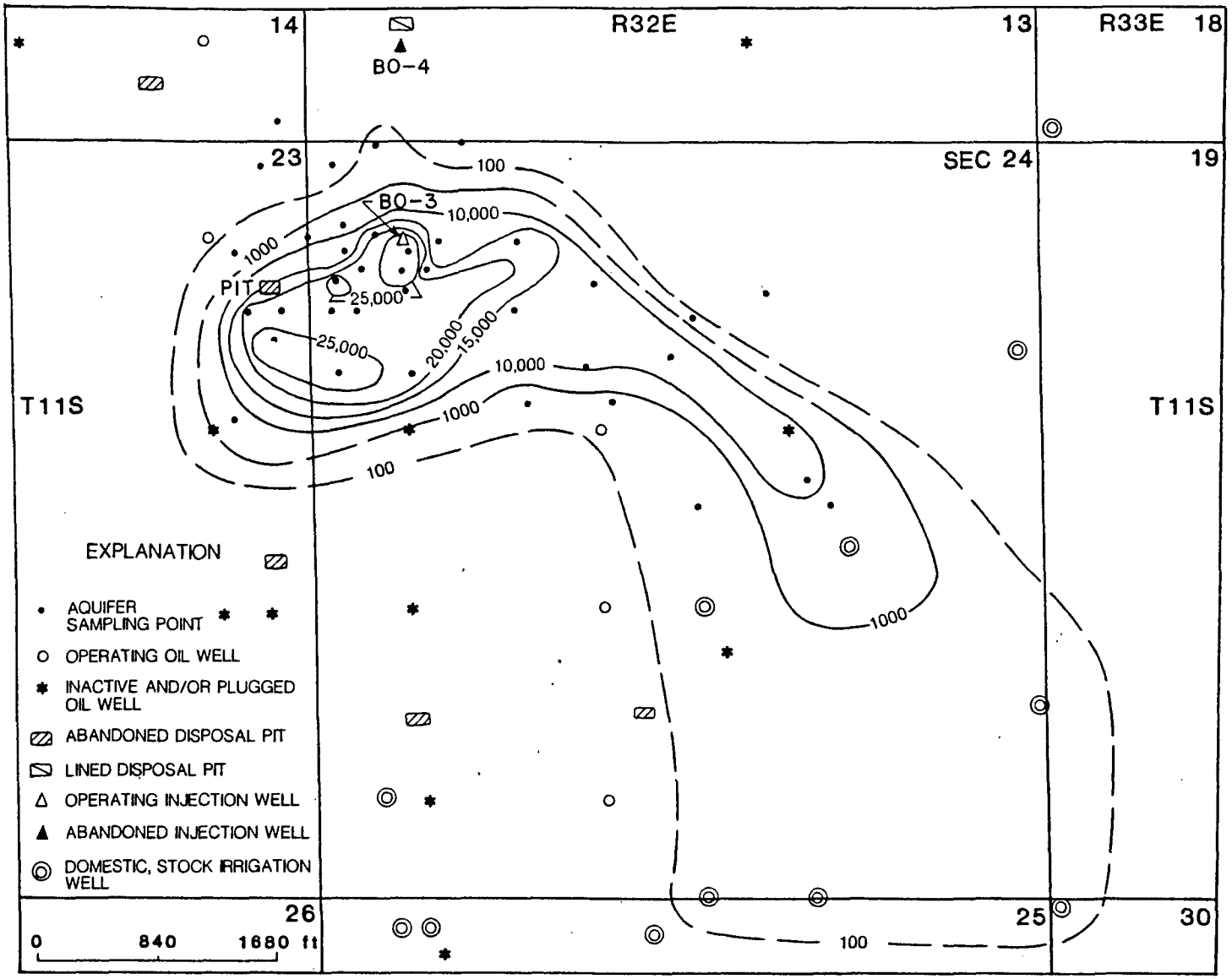
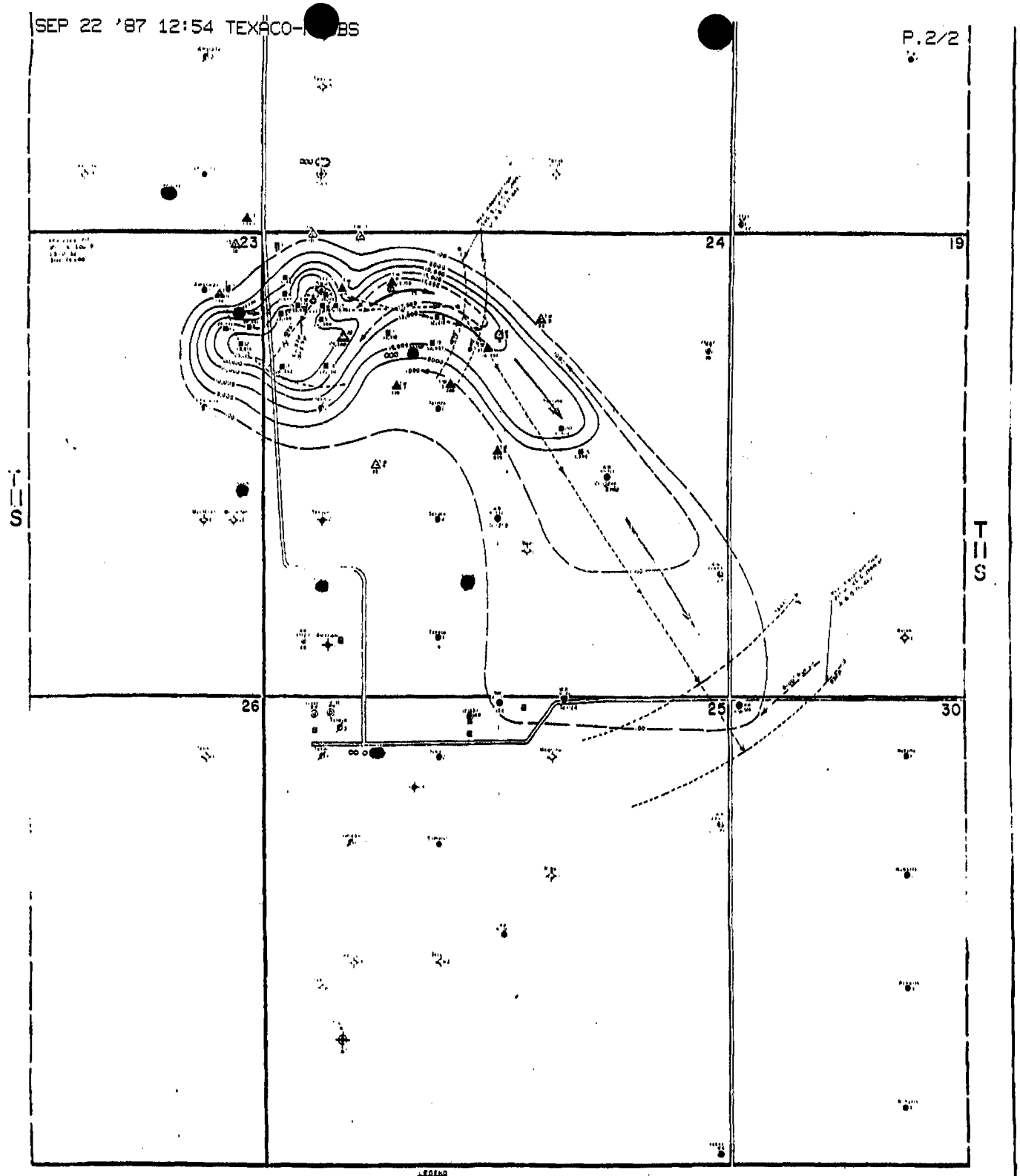


Figure 3. Chloride concentration contour map May 25, 1978 (modified from J. Runyan, NM Oil Conservation Division)



PAUL HAMILTON WATER CONTAMINATION STUDY

MOORE DEVONIAN POOL

MAP SCALE 1 inch = 500 feet

LEGEND

WATER TEST WELL - HAMILTON
WATER TEST WELL - TEXACO
WATER WELL
HOUSE
OIL WELL
TEXACO OIL WELL
P&A OIL WELL
P&A GAS WELL
GAS WELL
OPEN BATTERY
GAS (CONDENSATE) PIT

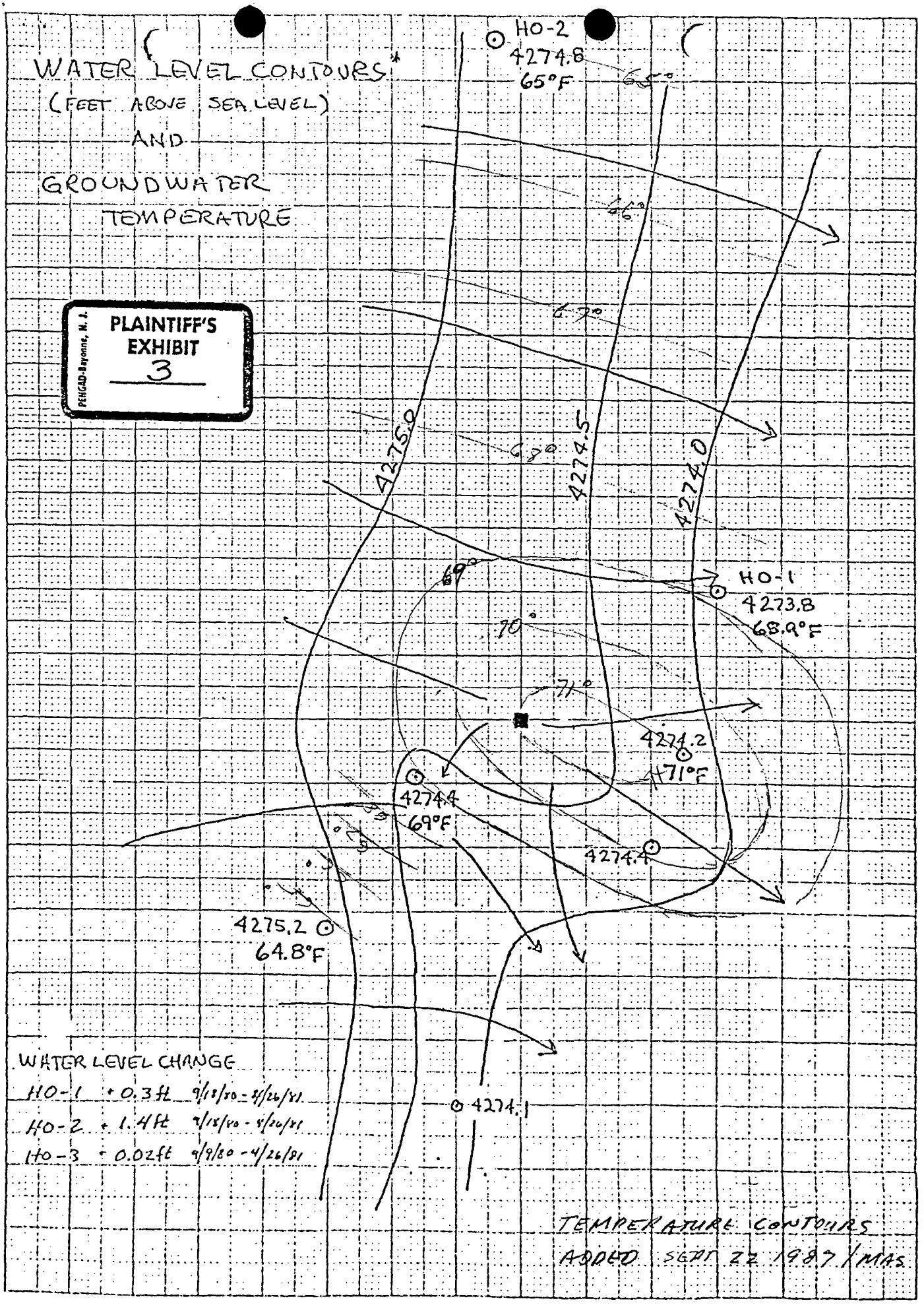
WATER RATE & MOVEMENT MAP

BASED ON WATER MOVEMENT RATES OF .6 & .9 FEET PER DAY FROM TWO POSSIBLE SOURCES OF CONTAMINATION

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
HOBBS, NEW MEXICO

JOHN W. RUNYAN - GEOLOGIST
May 1, 1979
Revised May 24, 1979

FIRST TRIAL AND SECOND TRIAL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4275.0
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4274.0
65°
66°
67°
68°
69°
70°
71°
WATER LEVEL CHANGE
HO-1 + 0.3 ft 9/18/80 - 4/26/81
HO-2 + 1.4 ft 9/18/80 - 4/26/81
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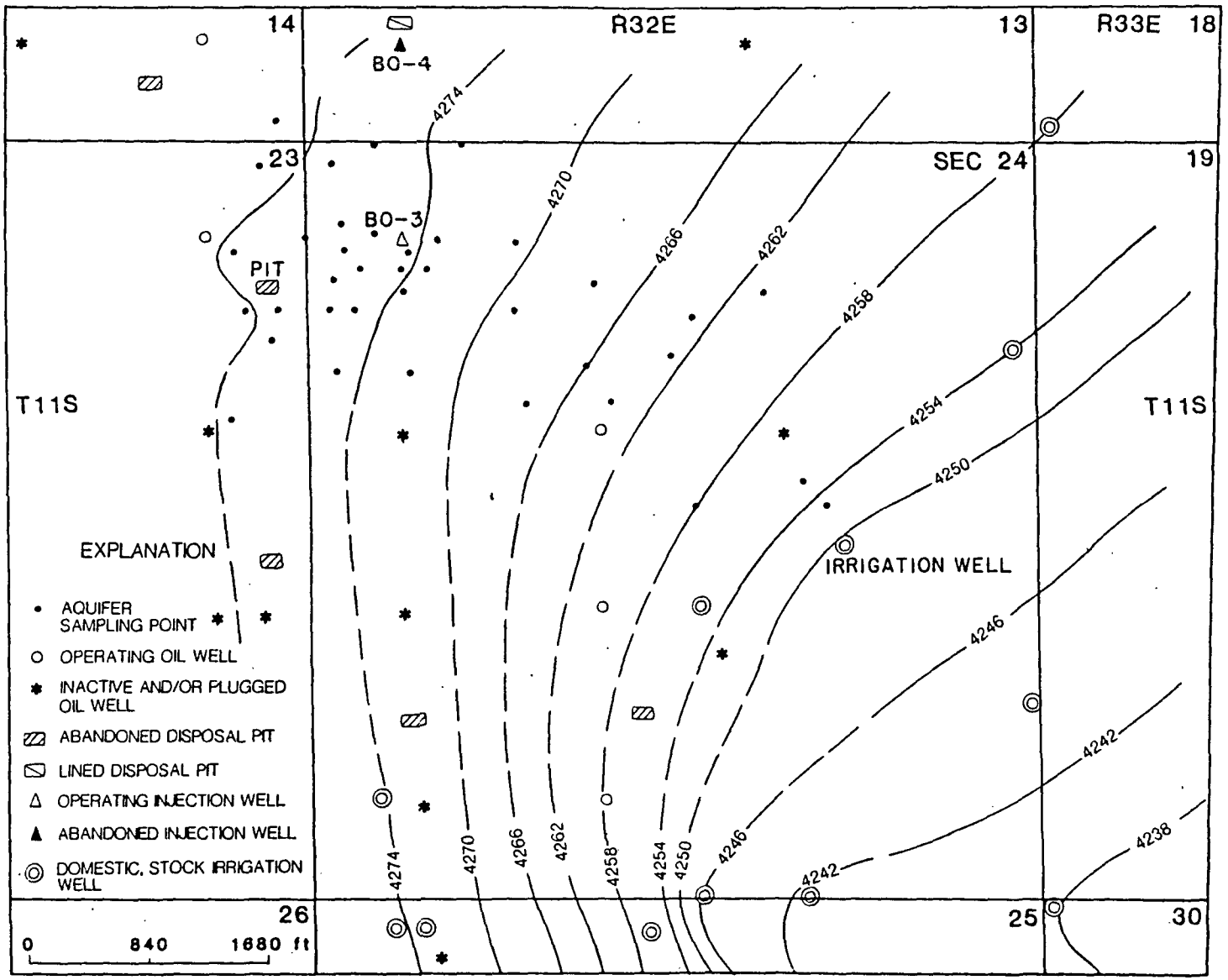
TEMPERATURE CONTOURS
ADDED SEPT 22 1987 KMAS



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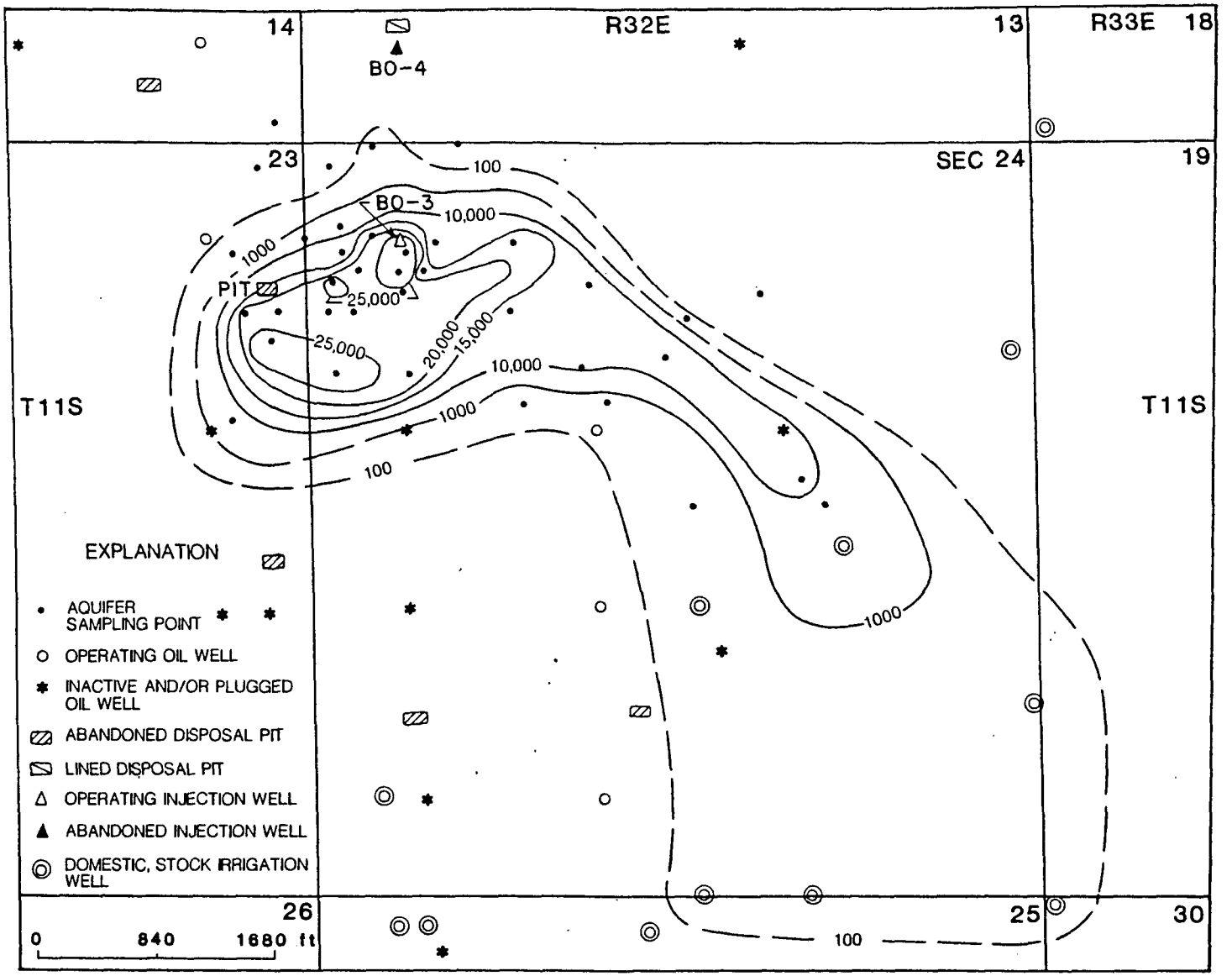
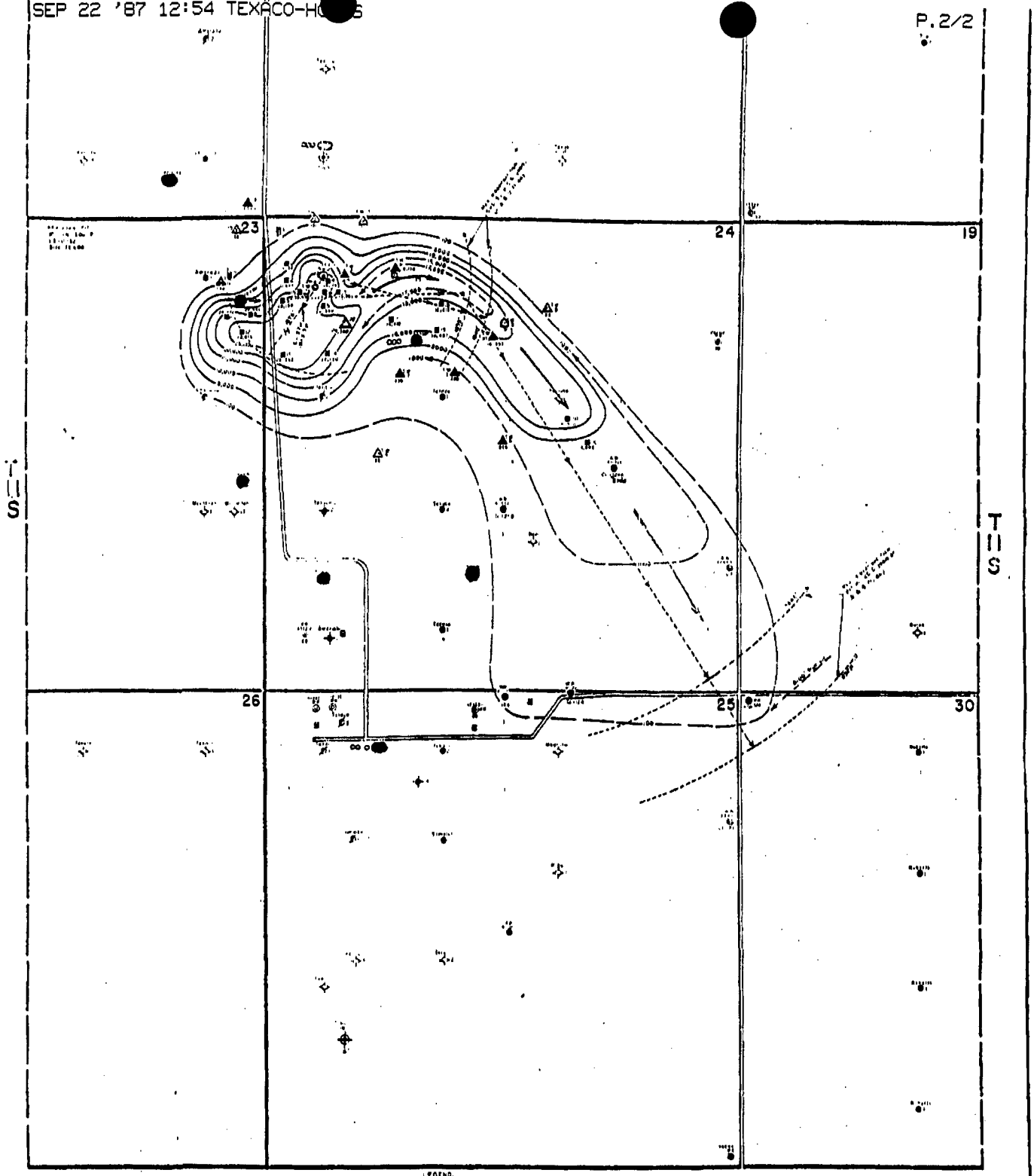


Figure 3. Chloride concentration contour map May 25, 1978 (modified from J. Runyan, NM Oil Conservation Division)



PAUL HAMILTON WATER CONTAMINATION STUDY

MOORE DEVONIAN POOL

MAP SCALE 1 inch = 500 feet

LEGEND

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WATER TEST WELL - TEXACO

WATER WELL

HOUSE

OIL WELL

TEXACO OIL WELL

P&A OIL WELL

P&A GAS WELL

GAS WELL

OPEN BATTERY

ABANDONED PIT

WATER RATE & MOVEMENT MAP

BASED ON WATER MOVEMENT RATES OF .8 & 1.9 FEET PER DAY FROM TWO POSSIBLE SOURCES OF CONTAMINATION

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
HOBBS, NEW MEXICO

JOHN R. RUNYAN - GEOLOGIST
May 1, 1978
Revised May 26, 1978

FIRST TRIAL AND SECOND TRIAL

FORM G-102 (12-73)

Moore Field: WATER PRODUCTION RECORD - PRIOR TO SWD SYSTEM

Barrels

upto May, 1958

	1952	1953	1954	1955	1956	1957	1958 (4 months production)	TOTAL WATER BEFORE SYSTEM	
AMERADA:									
C. W. Robinson #1	—	577	186	783	1176	18,417	11,503		
C. W. Robinson #2	—	92,208	149,177	102,698	145,075	158,967	53,267		
Total Robinson Lease	—	92,785	149,363	103,481	146,251	177,379	64,770	734,029	Robinson
C. W. Robinson "A" #1	—	—	—	—	—	1409	1562		
C. W. Robinson "A" #2	—	—	—	—	—	—	—		
Total Robinson "A" Lease	—	—	—	—	—	1409	1562	2971	Rob
State "MA" #1	—	—	—	—	—	—	—		
" " #2	—	—	—	—	2526	9685	4973		
" " #3	—	—	—	—	—	—	—		
State "MA" Lease Total	—	—	—	—	2526	9685	4973	17,184	State "MA"
A. M. Lee (originally Amerada)									
" " " Well No. 1	13,104	58,074	103,787	98,592	106,995	171,633	44,378	596,563	A. M. Lee
TEXACO:									
N.M. 'BR' State #1	—	—	—	959	379	—	—		
" " " #2	—	—	—	1347	517	—	—		
"BR" Lease Total	—	—	—	2306	896	—	—	3202	"BR" ST.
N.M. "BO" State #1	—	—	—	973	2221	—	—	3194	
" " " 2	—	—	—	—	—	—	—	—	
" " " 3	—	—	—	—	1396	—	825	1396	
" " " 4	—	—	—	18,007	74,707	185,009	84,786	362,509	
"BO" Lease Total	—	—	—	18,980	78,324	185,009	85,611	367,924	"BO" ST.